NUCLEAR SCIENCE ABSTRACTS

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September 15, 1975

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Volume 32, Number 5, September 15, 1975

NUCLEAR SCIENCE ABSTRACTS

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Published by the ERDA Technical Information Center

Nuclear Science Abstracts provides the only comprehensive abstracting and indexing coverage of the international nuclear science literature. It covers scientific and technical reports of the U. S. Energy Research and Development Administration and its contractors, other U. S. Government agencies, other governments, universities, and industrial and research organizations. In addition, books, conference proceedings, individual conference papers, patents, and journal literature on a worldwide basis are abstracted and indexed. Each issue of *Nuclear Science Abstracts* includes four indexes: subject, personal author, corporate author, and report number.

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Comprehensive indexes appear in each issue and are cumulated at the end of each volume. The report number indexes will be cumulated on both a volume and two-volume basis. Multivolume cumulations have been issued as indicated above.

All documents abstracted are indexed by subjects and personal authors. Report literature is indexed also by corporate author and report number. Each of these indexes in every issue is preceded by an introduction explaining in detail the organization of the index and the principles by which it is compiled. The reader is referred to these explanations for information not found in the brief summaries below.

Personal Authors

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

```
HOLLOWAY, J.A., Survey of image
    processing methods for
    radiography, 31:16491
HOLLWEG, J.V., Hydromagnetic waves in
    interplanetary space, 31:17953
HOLMBERG, E.B., Distribution of
    clusters of galaxies as related to
    galactic absorption, 31:18040
HOLMES, J.J., See BATES, J.F., 31:17444
```

Subjects

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

Examples:

```
NUCLEAR POWER PLANTS/REACTOR LICENSING
  Experience acquired in the design and construction of
    operating plants (German Federal Republic), 31:19104
NUCLEAR POWER PLANTS/REACTOR SAFETY
  Conception of radiation safety in atomic electric power
    plants, 31:15032 (CONF-701074-P1)
NUCLEAR POWER PLANTS/SITE SELECTION
  Safety-related site parameters for nuclear power plants,
    31:19052 (WASH-1361)
  Status and development of nuclear power in the Federal
    Republic of Germany, 31:19105
NUCLEAR PROPERTIES/RESEARCH PROGRAMS
  Accelerator physics group progress report, July--December
    1973 (Research summaries), 31:18544 (INS-R-139)
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Corporates

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

17606 (ANL/HEP-7440, pp I.1-I.12) ACCELERATED POLARIZED PROTONS AT THE ZGS. Ratner, L. G. (Argonne National Lab., IL). Feb 1974.
From symposium on high energy physics with polarized beams; Argonne, Illinois, USA (8 Feb 1974).
In symposium on high-energy physics with polarized beams.

is indexed as:

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ARGONNE NATIONAL LAB., ILL. (USA)
  Accelerated polarized protons at the ZGS, 31:17606
    (ANL/HEP-7440)
  Acceleration of polarized protons in synchrotrons,
    31:17692 (ANL/HEP-7440)
  Analysis of population, birth, and death statistics in
    the counties surrounding the Big Rock Point Nuclear
    Power Station, Charlevoix County, Michigan, 31:16552
    (ANL-8149)
  Argonne polarized target facilities, 31:17762 (ANL/HEP-
    7440)
  Calculation of transient fission-gas release from oxide
    fuels, 31:19031 (ANL-8143)
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Report Numbers

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. While not reports, patents and conference papers are indexed here as a matter of convenience.

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WASH-
  1164              31:19025  Dep. NTIS, $16.00
  1359              31:16524  Dep. NTIS, $10.60
  1361              31:19052  Dep. NTIS, $3.75

WCAP-             (Misc.)
  7906              31:19053  Dep. NTIS, $5.50

XDC-
  60-3-68           31:18403  Dep. NTIS, $7.25

XN-               (Non-ERDA)
  74-21(Rev.1)      31:19054
  209(Suppl.4)      31:18780  Exxon, Richland, WA
  (Rev.1)

Y-
  1966              31:19100  Dep. NTIS, $4.00
```

AVAILABILITY OF PUBLICATIONS ABSTRACTED

Public availability of all U. S. Energy Research and Development Administration reports is indicated in the report number indexes. The availability of other reports, when known, is also indicated. The availability of some unnumbered reports is given in the abstract.

Dissertations from *Dissertation Abstracts International, Part B* that are included in *Nuclear Science Abstracts* are available from Xerox University Microfilms, 300 North Zeeb Road, Ann Arbor, Michigan 48106.

Information on the availability of the published literature and unpublished conference papers abstracted in *Nuclear Science Abstracts* can be obtained from the USERDA Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

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The Administrator of the Energy Research and Development Administration has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this agency. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 30, 1978.

Volume 32, Number 5 September 15, 1975

NUCLEAR SCIENCE ABSTRACTS

CHEMISTRY

Analytical and Separations Chemistry

11137 URANIUM RECOVERY AS A BY-PRODUCT OF PHOSPHORIC ACID PRODUCTION. Ross, R. C. (United Nuclear Corp., Elmsford, NY). Trans. Am. Nucl. Soc.; 21: 245(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

Activation and Nuclear Reaction Procedures

Refer also to abstracts 11189, 11533, 11618, and 12241.

11138 COMPARISON OF THE DETERMINATION METHODS OF IMPURITIES IN BORON. Thevenot, F.; Viala, J. C. (Lyon-1 Univ., 69-Villeurbanne (France)). Analusis.; 3: No. 2, 76-84 (Feb 1975). (In French).

New techniques were developed to determine impurities in solid elementary boron. Spark mass spectrometry allows the localized analysis of all the elements by direct sparking and without using standards. This method has enabled study of the dry corrosion of solid boron in air up to 105°C. Activation by means of 54-MeV α-particles allows the non-destructive determination of oxygen. Isotope ^{18}F, with a half-life of 2 hours, is obtained. In the case of very pure boron, the sensitivity is reported to be about 1 to 10 ppm. Atomic absorption, a sensitive and precise method, makes possible the determination of various metals and silicon. The sensitivity coefficients of some elements in boron are evaluated by comparing the results given by these different techniques. (FR)

11139 RADIOACTIVATION ANALYSIS OF THE MINERAL CONTENT OF A HONEY. Possibility of Precising the Geographic Origin. Lasceve, G. (CEA Centre d'Etudes Nucleaires de Cadarache, 13-Saint-Paul-les-Durance (France). Service de Radio-Agronomie); Gonnet, M. (Institut National de Recherches Agronomiques (INRA), 84-Montfavet (France). Station Experimentale d'Apiculture). Apidologie; 5: No. 3, 201-223(1974). (In French).

The aim of the present study consists in searching whether there is a relation between the mineral composition of a honey and its geographic origin. The trace analysis is carried out by activation analysis with thermal neutrons on a 15 g (0.53 ounce) sample reduced to ashes under infra-red radiations. So about twenty elements can be recognized without resorting to chemical separation. The 15 samples analyzed contain the same trace elements but in proportions which are different enough to make possible the identification of each origin. Moreover the ratios Rb/Fe and Rb/Zn allow discrimination between light honeys and dark honeys and between Hungarian and French locusttree honeys. The use of a single element as indicator seems to be possible in a few special cases: the fir honey from the Loire area is the only one which contains silver. This memoir forms a preliminary study which must be precised and deepened by the analysis of several samples from the same place but harvested at different times in order to determine the variation boundaries of the various elements. (FR)

11140 STUDY OF SUPERFICIAL CONTAMINATION (BY O, C, N, F) OF METALS USING NUCLEAR MICROANALYSIS. Beranger, G. (Universite de Technologie de Compiegne, 60 (France)); David, D. (Ecole Normale Superieure, 75-Paris (France). Groupe de Physique des Solides); Garcia, E. A.; Lucas, X. (Paris-11 Univ., 91-Orsay (France)). Rev. Phys. Appl.; 10: No. 2, 87-94(Mar 1975). (In French).

The superficial contamination of titanium, zirconium, tantalum, niobium, copper, and other metals during surface treatments was studied. The oxygen, nitrogen, carbon, and fluorine contents were estimated by microanalysis. Several polishing methods, chemical or mechanical, were applied, as well as superficial etching by sputtering. The purpose is to determine the best method of surface preparation for subsequent physical or chemical studies, such as oxidation kinetics. (FR)

11141 DETERMINATION OF EXPOSURE OF ENVIRONMENTAL MONITORING FILM BY ACTIVATION OF SILVER TO ^{110}Ag (24.4 sec) WITH ^{252}Cf. Duffey, D. (Univ. of Maryland, College Park); Beck, W. L.; Gleason, G. I.; Wiggins, P. F. Trans. Am. Nucl. Soc.; 21: 93-94(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11142 BIOMEDICAL STUDIES USING NUCLEAR ACTIVATION TECHNIQUES. Dyer, N. C. (Aerojet Nuclear Co., Idaho Falls, ID); Brill, A. B.; Lyon, W. S. Trans. Am. Nucl. Soc.; 21: 95(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11143 ASSESSMENT OF PUBLIC HEALTH HAZARDS FROM URBAN METAL REFINERIES. Jervis, R. E. (Univ. of Toronto); Paciga, J. J.; Chattopadhyay, A. Trans. Am. Nucl. Soc.; 21: 95-97(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11144 STABLE TRACERS AND THEIR USE AS NUTRITIONAL MARKERS. Vogt, J. R.; Gray, D. H.; Luckey, T. D.; Martz, F. A.; Hutcheson, D. (Univ. of Missouri, Columbia). Trans. Am. Nucl. Soc.; 21: 97(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11145 TRACE ELEMENTS IN FOOD BY NEUTRON ACTIVATION ANALYSIS. Friedman, M. H.; Tanner, J. T. (Food and Drug Administration, Washington, DC). Trans. Am. Nucl. Soc.; 21: 97-98(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11146 ACTIVATION/RADIOCHEMICAL ANALYSIS FOR COPPER AND MERCURY IN BIOLOGICAL SAMPLES. Hankins, D. A.; Babb, A. L.; Scribner, B. H. (Univ. of Washington, Seattle). Trans. Am. Nucl. Soc.; 21: 98(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11147 METHODOLOGY FOR HIGH-FLUX ABSOLUTE MULTI-ELEMENT NAA. Ricci, E. (Oak Ridge National Lab., TN). Trans. Am. Nucl. Soc.; 21: 99(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11148 TRACE ELEMENTS IN COALS OF THE UNITED STATES DETERMINED BY ACTIVATION ANALYSIS AND OTHER TECHNIQUES. Ruch, R. R.; Cahill, R. A.; Frost, J. K.; Camp, L. R.; Gluskoter, H. J. (Illinois State Geological Survey, Urbana). Trans. Am. Nucl. Soc.; 21: 107-108(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11149 NEUTRON ACTIVATION ANALYSIS OF COALS USING INSTRUMENTAL TECHNIQUES. Millard, H. T.; Swanson, V. E. (Geological Survey, Lakewood, CO). Trans. Am. Nucl. Soc.; 21: 108-109(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11150 CAPTURE-GAMMA-RAY ANALYSIS OF SULFUR IN OIL. Profio, A. E.; Pouraghabagher, A. R. (Univ. of California, Santa Barbara). Trans. Am. Nucl. Soc.; 21: 109-110(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11151 NEUTRON ACTIVATION ANALYSIS: A USEFUL TOOL FOR EVALUATING WATER SAMPLING AND ANALYSIS TECHNIQUES. Harrison, S. H. (National Bureau of Standards, Washington, DC). Trans. Am. Nucl. Soc.; 21: 110-111(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11152 NEUTRON ACTIVATION ANALYSIS. Verheijke, M. L. (Philips Gloeilampenfabrieken VN, Eindhoven, Netherlands). Philips Tech. Tijdschr.; 34: No. 11/12, 339-347(1974). (In Dutch).

After irradiation with thermal neutrons in a nuclear reactor, the energy spectrum of a sample is registered with a Ge(Li)-detector and a pulse-height analyzer. The position and the area of the different peaks are fed into a computer which yields a qualitative and quantitative analysis of the constituting elements of the sample. The very sensitive method (detection limits are possible to 10^{-14} g) is especially suitable for trace analysis. The spectrum of each sample is taken four times: 3 hours, 1 day, 1 week, and 1 month after irradiation. For the identification of the nuclides not only the energy of the peaks but also the half-lives are used. Formulae for the computation of the data as well as flow diagrams of two programs and some printouts are given. The data concerning the (n,γ) reactions of the different elements and the detectors used constitute a "library" which is stored in the memory of the computer. An example of this library is printed. The neutron flux in the reactor is determined at each run by irradiating a known amount of cobalt together with the sample and measuring its activity afterwards. For each place in the reactor the cadmium ratio should also be known, which gives the ratio of the fluxes of the thermal and epithermal neutrons. (INIS)

11153 MULTIELEMENT RESIDUES IN TISSUES OF GUINEA PIGS FED SWEET CLOVER GROWN ON FLY ASH. Furr, K. (Virginia Polytechnic Inst. and State Univ., Blacksburg); Stoewsand, G. S.; Bache, C. A.; Gutenmann, W. A.; Lisk, D. J. Arch. Environ. Health; 30: No. 5, 244-248(May 1975).

Yellow sweet clover (Melilotus officinalis) was harvested from fly ash dumped in a landfill site at Lansing, NY. This clover was chopped, dried, and formulated at 45% into an otherwise purified diet and fed to six guinea pigs for 90 days. Control sweet clover was harvested from gravelly subsoil and processed and fed to another group of guinea pigs for the same period. Samples of fly ash, gravelly subsoil, sweet clover, liver, kidneys, and left-rear gastrocnemius muscle of all guinea pigs were freeze-dried and analyzed for 35 elements by neutron activation analysis. The fly ash contained 28 elements at higher levels than the gravelly subsoil, while the clover harvested from fly ash contained 19 elements in increased amounts over those in the clover harvested from the gravel soil. Growth rate of both groups of guinea pigs was similar. Rubidium and selenium were present at higher levels in the tissues of guinea pigs fed the fly ash clover. (auth)

11154 MULTIELEMENT STANDARD FOR NEUTRON ACTIVATION ANALYSIS WHICH PREVENTS LOSSES OF MERCURY FROM PLASTIC CONTAINERS. Randa, Z.; Kuncir, J.; Benada, J. (Inst. of Mineral Raw Materials, Kutna Hora, Czech.). Radiochem. Radioanal. Lett.; 21: No. 6, 349-355(16 Jun 1975).

A multielement standard (MES) was prepared for the simultaneous determination of seven trace elements (Ni, Cd, In, Sb, Te, Au and Hg) by NAA. It was found that this MES prevents losses of mercury from polyethylene capsules during irradiation in a reactor. (auth)

11155 URANIUM DETERMINATION IN FROZEN WATER SAMPLES USING THE FISSION TRACT TECHNIQUE. Reimer, G. M. (U. S. Geological Survey, Denver). Radiochem. Radioanal. Lett.; 21: No. 6, 339-342(16 Jun 1975).

A new method is presented of general systematic inorganic analysis on the ultramicro scale, which consists of fixing the ions selectively on the individual grains of ion exchange resins, and then identifying them by means of colorimetric tests on the resins. A scheme was developed for the analysis comprising 14 cations, and the results permit the application of this technique to the study of a large number of ions. (auth)

11156 ROUTINE PROCEDURE FOR MULTIELEMENT ANALYSIS OF ATMOSPHERIC PARTICULATES BY INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS. Kronborg, O. J.; Steinnes, E. (Institutt for Atomenergi, Kjeller, Norway). Radiochem. Radioanal. Lett.; 21: No. 6, 379-387(16 Jun 1975).

A simple neutron activation procedure for the routine determination of about 20 elements in air particulates is presented. A short irradiation followed by one Ge(Li) γ-counting after 10 min permits the determination of 10 elements. The rest of the elements are determined by one counting performed 1-2 weeks after a long irradiation. Two different procedures for the long irradiation are described. Some data illustrating the precision and accuracy of the method are presented. (auth)

Chemical and Spectral Procedures

Refer also to abstract 11254.

11157 AN ANALYTICAL STUDY OF PHOTOCHEMICAL REDUCTION OF URANIUM (VI) WITH SODIUM HYPOPHOSPHITE. Eswara Duit, V. V. S.; Radhakrishnamurty, C. (Andhra Univ., Waltair (India). Dept. of Chemistry; Andhra Univ., Waltair (India). Dept. of Chemical Engineering). Analusis.; 3: No. 1, 55-57(Jan 1975).

A photochemical procedure for the quantitative reduction of uranium(VI) to uranium(IV) using sodium hypophosphite was developed. The uranium(IV) so formed is subsequently titrated with a standard solution of sodium vanadate using barium diphenylamine sulphonate as indicator. Quantities of 10 to 200 mg of uranium can be determined with a standard deviation of less than 0.5%. A high pressure mercury vapor lamp serves as the light source for the photolysis. (FR)

11158 RAPID DETERMINATION OF HYDROGEN IN STEELS AND NONFERROUS METALS. Boillot, P.; Hanin, M. (Institut de Recherches de la Siderurgie Francaise (IRSID), 78-Saint-Germain-en-Laye). Analusis.; 3: No. 2, 65-75(Feb 1975). (In French).

After reviewing the main characteristics of hydrogen determination in liquid steel (sampling and analysis) a new rapid method is described in which the sample is melted in nitrogen as carrier gas. Quantitative extraction is achieved in one to three minutes. The kinetics of the reaction is followed by recording the degassing produced during fusion. Liquid steel samples, 8 mm in diameter, were analyzed by both this method and the conventional hot extraction method used as a reference of the hydrogen concentration range 0.1 to 10 ppM. The average results are identical. The analytical and sampling error lies between 0.1 and 0.15 ppM for a hydrogen content 4 ppM. This method was used to determine the hydrogen content of non-ferrous metals such as silver, aluminum, copper, nickel, palladium, platinum, titanium, and tantalum. (FR)

11159 THE NATURE AND VARIATIONS OF THE INTERACTIONS ENCOUNTERED IN THE DETERMINATION OF STRONTIUM BY ATOMIC ABSORPTION SPECTROPHOTOMETRY IN BIOLOGICAL MEDIA. Rousselet, F.; El Solh, N.; Girard, M. L. (Paris-5 Univ., 75 (France)). Analusis.; 3: No. 1, 44-54(Jan 1975). (In French).

The interactions encountered in the determination of strontium by atomic absorption spectrophotometry in biological media are numerous. Their importance, and sometimes their direction, vary considerably with the nature and the oxidizing or reducing character of the flame used and the region of the latter which is optically analyzed. It is possible, by a careful choice of the instrumental parameters, to reduce to a great extent the effects of the chemical matrix on the degree of atomization. (FR)

11160 SOLVENT EXTRACTION OF URANIUM(VI) BY N-m-TOLYL-o-METHOXYBENZOHYDROXAMIC ACID. Agrawal, Y. K. (Indian Inst. of Tech., Powai). Sep. Sci.; 10: No. 2, 167-173(1975).

A simple and rapid spectrophotometric determination of uranium(VI) is described. The uranium(VI) N-m-tolyl-o-methoxybenzohydroxamic acid complex is extracted with chloroform at pH 5.3 to 5.5 from aqueous solution. Maximum absorption of orange-red extract occurs at 510 nm. The colored complex obeys Beer's law over the range 0.3 to 20 ppm of uranium. The effect of acidity, reagent concentration, and diverse ions on the visible absorption of extracted complex has been studied. (auth)

11161 SYSTEMATIC INVESTIGATION OF SOME CATIONS ON THE ULTRAMICRO SCALE ON GRAINS OF ION EXCHANGE RESINS. Noe, M. (Univ., Liege). Mikrochim. Acta; 1: No. 5-6, 663-674(1975). (In German).

11162 STUDIES ON THE CATALYTIC DETERMINATION OF Os AND Ru IN THE NANOGRAM SCALE. Mueller, H.; Otto, M. (Univ., Leipzig). Mikrochim. Acta; 1: No. 5-6, 519-532(1975). (In German).

The Os and Ru catalyzed oxidation of 1-naphthylamine by NO_3^- is discussed. The reaction was followed spectrophotometrically by measuring the rate of change in absorbance of the azo dye which is formed during the reaction. It was found that the rate of the reaction depends linearly on the concentration of the oxidizing agent NO_3^-. The catalytic activity of Os is influenced by the concentration of 1-naphthylamine, but the activity of Ru is not. The limiting concentration for the determination of Os (relative error 10.1%) is 1.74ng/ml in 2 ml and for Ru (relative error 11.7%) 4.85ng/ml, respectively. The influence of 9 ions which usually accompany Os and Ru was also studied. (auth)

11163 REACTIONS OF RARE EARTH ELEMENTS WITH BOROPYROCATECHOL VIOLET COMPLEXES. Serdyuk, L. S.; Karaseva, L. B.; Korotun, M. V. (Chernowitz State Univ., USSR). Ukr. Khim. Zh.; 41: No. 4, 366-370(Apr 1975). (In Russian).

The reactions of rare earth elements with pyrocatechol violet in the form of its slightly stable boron complex were studied by spectrophotometric methods. Very stable complexes are formed with the rare earth elements. The dependence of the optical density of the rare earth complexes on the atomic number and the concentration of the boric acid in the solution was studied. A difference in the stability of the complexes was found that can be the basis of a method for the individual determination of the rare earths. A photometric method was developed for the determination of Lu in the presence of Pr. (tr-auth)

11164 DETERMINATION OF IRON IN ZIRCONIUM BY ELECTROLYTIC DISSOLUTION AND ATOMIC ABSORPTION SPECTROSCOPY. Mantel, M.; Aladjem, A. (Soreq Nuclear Research Centre, Yavne, Israel). Anal. Lett.; 8: No. 6, 415-420(1975).

A simple method for the determination of iron in the range of 0.01 to 1.00 percent in zirconium metal and its alloys is described. The method is based on the electrolytic dissolution of zirconium into an organic solvent and the subsequent measurement of iron by atomic absorption spectroscopy. The method is rapid, requiring 30 minutes for one measurement. (auth)

11165 MASS SPECTROMETRIC DETERMINATION OF CARBON 14. Anbar, M. (to Stanford Research Inst.). US Patent 3,885,155. 20 May 1975. Filed date 1 Nov 1973. 4p.

A determination of the amount of ^{14}C in a substance is made simpler and more accurate by introducing the ^{14}C in the form of CO_2 into a duoplasmatron negative ion source for a mass spectrometer together with $^{15}N_2$ producing CN^-, as the predominate ion. The spectrometer can then accurately detect the amount of ^{14}C. (auth)

Radiometric and Radiochemical Procedures

Refer also to abstracts 11556, 11621, 11627, 11841, 11842, 11850, and 12917.

11166 MINIMUM-DETECTABLE ACTIVITY OF BETA-PARTICLE EMITTERS BY SPECTRUM ANALYSIS. Plato, P. (Michigan Univ., Ann Arbor (USA). Dept. of Environmental Health); Oller, W. L. (National Center for Toxicological Research, Jefferson, Arkansas 72079, USA). Nucl. Instrum. Methods; 125: No. 1, 177-181(15 Mar 1975).

Minimum-detectable activities (MDA's) for ^3H, ^{14}C, and ^{32}P were determined experimentally by the method of beta-particle spectrum analysis and compared to corresponding theoretically possible MDA's by using the integrated count rate for each radionuclide. The lowest MDA's determined experimentally for ^3H, ^{14}C, and ^{32}P were 5.5, 3.5, and 2.5 picocuries, respectively. MDA values were determined for these three radionuclides individually, and for ^3H in the presence of ^{14}C and ^{32}P to demonstrate the influence of other radionuclides on the MDA of a given radionuclide. MDA values were also determined for the three radionuclides as a function of sample counting time. (auth)

11167 DETERMINATION OF THE BROMINE CONTENT OF PHARMACEUTICAL PREPARATIONS BY RADIOISOTOPE-EXCITED X-RAY ANALYSIS. Havranek, D.; Bumbalova, A.; Nemcikova, A. (Comenius Univ., Bratislava). Farm. Obz.; 43: No. 4, 147-150(1974). (In Czech).

This method was used for the determination of Br in sedatives and hypnotics containing bromvaletone, with the use of a single calibration graph. The emitter $^{147}Pm/Te$ was used for the excitation of Br radiation. The method is as accurate as the argentimetric procedure and is more rapid. (Anal. Abstr.)

11168 IN REGARD TO THE QUESTION OF THE DETERMINATION OF HEAVY METALS IN RIVER WATERS WITH THE AID OF RADIONUCLIDE X-RAY-FLUORESCENCE ANALYSIS. Meier,H.; Unger, E.; Albrecht, W.; Boesche, D.; Hecker, W.; Mege, P.; Zeitler, G.; Zimmerhackl, E. (Staatliche Forschunginstitut fuer Geochemie, Bamberg, Ger.). Mikrochim. Acta; 1: No. 5-6, 505-517(1975). (In German).

A discussion is given of the fundamentals of energy-dispersive x-ray fluorescence analysis that involves radioactive nuclide sources in combination with Si(Li) semi-conductor detectors or proportional counter tubes. By means of examples it was shown that the procedure is suitable for the rapid determination of dissolved or suspended pollutants of river waters and sediments. Among others there is included the possibility of the direct analysis of samples of water as well as the analysis of specimens without involving preliminary chemical treatment by evaporation or centrifugation. The lowest concentrations of 0.1 ppm were established to be the detection limits. (auth)

11169 RESOLVING POWER OF GAUGE FOR $^{235}U-^{239}Pu$ MIXTURES. Notea, A.; Segal, Y. (Israel Inst. of Tech., Haifa). Trans. Am. Nucl. Soc.; 21: 195-196(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11170 ORE PROCESS ANALYSIS WITH NEUTRON CAPTURE GAMMA RAYS USING CALIFORNIUM-252. Duffey, D.; Wiggins, P. F.; Senftle, F. E. Trans. Soc. Min. Eng. AIME; 254: 113-117 (1973).

An examination of the neutron capture gamma ray method using a ^{252}Cf neutron source indicates that this technique may be feasible for process stream analysis of ores. Simulated laboratory experiments were made on Fe in taconite and magnetite, and Cu and Ni in their respective ores. Satisfactory analyses were obtained for 500 to 1000 g samples in a combined irradiation and counting time of 100 min. For large industrial size samples this time could be shortened. Based on these experiments, a set of guidelines are given for the use of the neutron capture gamma method in an industrial mill. (Metals Abstr.)

11171 POSSIBLE APPLICATION OF COMPUTER IN RADIOMETRIC ORE PROCESSING PLANT. Halik, L. (Uranova Doly, Dolni Rozinka, Czech.). Rudy (Prague); 22: No. 7, 191-195 (Jul 1974). (In Czech).

The possibility is dealt with of applying an integrated computerized and technological evaluation of operation in an ore processing plant. The analysis of input and output products yields suitable distribution limits of the raw material being sorted, with dissimilar technological-statistical characteristics. (INIS)

11172 FEASIBILITY STUDY OF IN SITU SEDIMENT ANALYSIS BY X-RAY FLUORESCENCE. Cooper, J. A.; Nielson, H. L.; Wogman, N. A.; Perkins, R. W. (Battelle Northwest, Richland, WA). Nucl. Technol.; 26: No. 2, 224-231(Jun 1975).

It has been established that energy dispersive x-ray fluorescence can provide in situ sediment analysis detectabilities that approach those attainable in the laboratory and that can be used to map the concentration of many heavy element pollutants in lakes, rivers, and estuaries. The method involves excitation with a ^{109}Cd radioisotopic source and analysis of the x rays with an Si(Li) detector housed in a solid-cryogen cryostat with a 0.005-in.-thick Be window. This system, with available technology, would be capable of providing analyses for about 13 elements (Cr, Mn, Fe, Ni, Cu, Zn, As, Br, Rb, Sr, Y, Zr, and Pb) at their typical concentration levels and could provide lower limit values in the 5- to 20-ppM range for Au, Hg, Se, Ge, and Ga in analysis times of about 4 min. A system using advanced excitation techniques should be capable of providing low ppM detectabilities in analysis times of 2 to 3 min. The concentration of Cd could be determined at levels of about 20 ppM but would require a special excitation source. Various experimental arrangements were considered and experimental results for simulated in situ analysis were obtained. (auth)

Separation Procedures

Refer also to abstract 11261.

11173 (IS-T-677) SIMULATION AND CONTROL SYNTHESIS FOR A PULSE COLUMN SEPARATION SYSTEM FOR PLUTONIUM-URANIUM RECOVERY. McCutcheon, E. B. (Ames Lab., Iowa (USA)). May 1975. Contract W-7405-eng-82. 158p. Dep. NTIS $11.00.

Thesis.

Control of a plutonium-uranium partitioning column was studied using a mathematical model developed to simulate the dynamic response and to test postulated separation mechanisms. The column is part of a plutonium recycle flowsheet developed for the recovery of plutonium and uranium from metallurgical scrap. In

the first step of the process, decontamination from impurities is achieved by coextracting plutonium and uranium in their higher oxidation states. In the second step, reduction of the plutonium to a lower oxidation state allows partitioning of the plutonium and uranium. The use of hydroxylamine for the plutonium reduction in this partitioning column is a unique feature of the process. The extraction operations are carried out in pulse columns. (LK)

11174 (RFP-2380) RECOVERY OF PLUTONIUM METAL FROM TANTALUM CRUCIBLES BY HYDRIDING. DeGrazio, R. P.; Berry, J. W. (Dow Chemical U.S.A., Golden, Colo. Rocky Flats Div.). 30 May 1975. Contract AT(29-1)-1106. 6p. Dep. NTIS $4.00.

A procedure is described for the recovery of plutonium metal, in the form of melts, from tantalum crucibles by hydriding. (auth)

11175 (SRO-854-3) FUNDAMENTAL STUDIES OF SEPARATION PROCESSES. Technical Progress Report. Rogers, L. B. (Georgia Univ., Athens (USA). Dept. of Chemistry). Jun 1975. Contract AT(38-1)-854. 11p. Dep. NTIS $4.00.

Studies using high-precision gas chromatography and supercritical fluid chromatography have produced new types of information on liquid crystals and on behavior of substances in the region of the critical temperature, respectively. In addition, the first successful studies of the effects of pressure on cation exchange have been made using aqueous solutions of alkali metal nitrates. In contrast, progress on separations of isotopic species using gas chromatography has been disappointing. In that area, the chief accomplishment has been a determination of the levels of accuracy and precision with which isotopic abundances can be measured using our quadrupole mass spectrometer. (auth)

11176 STUDY OF THE SYNERGETIC EFFECT DURING THE EXTRACTION OF LANTHANIDES FROM MOLTEN ALKALI NITRATES. Foos, J. (Paris-11 Univ., 91-Orsay (France). Div. de Radiochimie); Mesplede, J.; Rouchouse, A. (Lyon-1 Univ., 69-Villeurbanne (France)). Bull. Soc. Chim. Fr.; No. 1, 125-129(Jan 1975). (In French).

The synergetic effect observed when extracting Nd, Eu, Gd, Yb in solution in the molten eutectic $LiNO_3-KNO_3$ was studied. The extracting agent couples used were: TTA-TLA; TTA-TBP; and TTA-TPPO (TTA = thenyltrifluoroacetone; LTA = trilaurylamine; TBP = tributylphosphate; TPPO = triphenylphosphine oxide). The resulting synergism is less important than that observed when extracting from aqueous media. No synergism was observed for Yb in the TTA-TLA system and Nd in the TTA-TBP system. (FR)

11177 EXTRACTION OF HEXAVALENT URANIUM AND QUADRIVALENT PLUTONIUM BY TRIBUTYLPHOSPHATE: INTERFACIAL MASS TRANSFER. Moszkowicz, P.; Kikindai, T. (Ecole Centrale des Arts et Manufactures, 92-Chatenay-Malabry (France). Lab. de Chimie Nucleaire Appliquee; CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif). C. R., Ser. C.; 280: No. 6, 321-324(10 Feb 1975). (In French).

Interfacial extractions of hexavalent uranium and tetravalent plutonium by tributylphosphate show a first order dependence with neutral species of these metals in nitric acid media and show a second order dependence with the extractory agent. The limiting step is the interfacial complexation by two TBP molecules. Effects of temperature have been studied and apparent activation energies for extractive reactions were measured. (FR)

11178 THE EXTRACTION OF ZIRCONIUM FROM HYDROCHLORIC OR PERCHLORIC SOLUTIONS BY DI-2-ETHYLHEXYLPHOSPHORIC ACID. Carbonnier, J. L.; Kikindai, T. (Ecole Centrale des Arts et Manufactures, 92-Chatenay-Malabry (France); CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif). C. R., Ser. C.; 280: No. 10, 619-621(10 Mar 1975). (In French).

The extraction of 10^{-4} M zirconium from HCl or $HClO_4$ solutions by HDEHP has been studied. An ionic exchange mechanism for low acid concentrations and a solvation mechanism for high acid concentrations are proposed. The increase of aqueous phase activity becomes a predominant factor at high acid concentrations. (FR)

11179 SEPARATION OF METAL IONS ON TITANIUM(IV) MOLYBDATE PAPERS. Rawat, J. P.; Mujtaba, S. Q. (Aligarh Muslim Univ., India). Sep. Sci.; 10: No. 2, 151-160(1975).

Papers impregnated with titanic molybdate have been used to chromatograph various cations in sodium nitrate solutions of 0.1 to 4 M concentrations. Various important separations are listed. The movement of the cations is proportional to the activity of the developing medium. Various plots are made to discuss the theoretical behavior of movement of cations on these papers. (auth)

11180 EXTRACTION OF INDIUM(III), LANTHANUM(III), AND BISMUTH(III) FROM SULFURIC ACID SOLUTIONS BY di-(2-ethylhexyl)PHOSPHORIC ACID. Sato, T. (Shizuoka Univ., Hamamatsee, Japan). J. Inorg. Nucl. Chem.; 37: No. 6, 1485-1488(Jun 1975).

Distribution of indium(III), Lanthanum(III) and bismuth(III) between sulfuric acid solutions and solutions of di-(2-ethylhexyl)phosphoric acid (DEHPA) in kerosene was investigated. The organic phases have been studied by ir and NMR spectroscopy. The mechanism of the extraction is discussed. (auth)

11181 DESORPTION OF IODINE FROM ACTIVE CARBON BY CAUSTIC ALKALI SOLUTION IN AN ULTRASONIC FIELD. Belogovskii, A. B.; Galkin, V. A.; Golubev, V. N.; Aleshin, B. N. J. Appl. Chem. USSR.; 47: No. 11, 2673(Nov 1974).

Translated from Zh. Prikl. Khim.; 47: No. 11, 2559-2560(Nov 1974).

Data are reported on the influence of an ultrasonic field on desorption of iodine from KAD-iodine active carbon by NaOH solution. (LK)

11182 HIGH TENSION ELECTROPHORETIC SEPARATION OF INORGANIC IONS WITH SPECIAL CONSIDERATION OF THE PLATINUM METALS. V. Meier, H.; Zimmerhackl, E.; Albrecht, W.; Boesche, D.; Hecker, W.; Menge, P.; Unger, E.; Zeitler, G. (Staatlichen Forschunginstitut fuer Geochemie, Bamberg, Ger.). Mikrochim. Acta; 1: No. 5-6, 461-471(1975). (In German).

The high tension electrophoretic migration of the halogeno complexes of the platinum metals and various metal ions was investigated in citrate buffers, acetate solution, and in fundamental electrolyte solutions containing NaCl. By this study it was found that the migration velocities of halogeno complexes of the platinum metals can be greatly increased by employment of fundamental electrolytes containing HCl and above all by using those containing NaCl. The sharp migration permits spearations of the osmium-, iridium-, platinum-group from the light platinum metal group as well as from numerous metal ions. The systematic change of the migration velocity of Cu^{2+}, Zn^{2+}, Pb^{2+} and others in various acetates, which follows the order, in the case of the inserted acetate actions: pyridine $<NH_4^+<(C_2H_5)_2NH_2^+$, <Na, demonstrate the reproducible influence of acetate ligands on the migration of simple ions. The applicability of the mixed electrolytes for the electrophoretic separations was shown on the basis of separation examples, namely Pt, Bi, Cu, Hg; Fe, Mn, Pt, Pd; Os, Ru, Zn, Cu; Re, Cu, Au, Zn. (auth)

11183 ABSORPTION SEPARATION OF TITANIUM AND ZIRCONIUM BY SULFURIC ACID SOLUTIONS IN PRESENCE OF ACETIC ACID. Balushev, B. S.; Zagorchev, B. N.; Takhova, R. D. (Chemical-Technological Inst., Sofia). Compt. Rend. Acad. Bulg. Sci.; 28: No. 1, 95-98(1975). (In Russian).

The efficiency of the cation exchanger KU-2 and the anion exchanger AV-17 in the separation of Ti and Zr from H_2SO_4 solution in the presence of acetic acid was investigated. The experimental results are tabulated. Elution curves from AV-17 are also given for Ti using 0.1N H_2SO_4 and 0.5% H_2O_2 and for Zr using 1N HCl. The results obtained indicate that AV-17 was more effective in the separation of the two elements. (JSR)

11184 CATION EXCHANGE OF ELEMENTS OF THE THIRD GROUP OF THE PERIODIC SYSTEM IN NaF AND KF SOLUTIONS IN SORPTION AND DESORPTION PROCESSES. Pakholkov, V. S.; Zelenkov, B. N. J. Appl. Chem. USSR.; 47: No. 12, 2745-2748(Dec 1974).

Translated from Zh. Prikl. Khim.; 47: No. 12, 2654-2657(Dec 1974).

Study of sorption and desorption of aluminum, gallium, indium, and thallium (I) under dynamic conditions from 0.01 N MeF_3(TIF)-NaF(KF)-H_2O solutions by KU-2 × 8 cation-exchange resin in H^+ form at various NaF and KF concentrations showed that only Tl^+ ions are eluted easily and completely from the resin by NaF and KF solutions. Al^{3+}, Ga^{3+}, and In^{3+} ions, and also Sc^{3+} ions, are not eluted at all by 0.5-1.0 N NaF solutions. It was shown on the basis of sorption and desorption experiments that ions of Group III elements can be separated, and thallium ions can be freed from other elements of this group, and the conditions for such separations were found. (auth)

11185 DETERMINATION OF THE STABILITY CONSTANTS FOR THE COMPLEXES OF RARE-EARTH ELEMENTS AND TETRACYCLINE. Saiki, M.; Lima, F. W. (Instituto de Energia Atomica, Sao Paulo, Brazil). Radiochem. Radioanal. Lett.; 21: No. 6, 371-378(16 Jun 1975).

Stability constants for europium, terbium, and thulium complexes with tetracycline were determined by the methods of average number of ligands, the limiting value, the two parameters and by weighted least squares. The technique of solvent extraction

was applied to obtain the values of the parameters required for the determination of the constants. (auth)

11186 DISTRIBUTION OF TERBIUM IN THREE-PHASE SYSTEMS. Lengyel, T. (Inst. of Isotopes, Budapest). Radiochem. Radioanal. Lett.; 21: No. 6, 389-393(16 Jun 1975).

The distribution of terbium in the three-phase system: organic extractant, molten lithium nitrate-ammonium nitrate eutectic and metallic gallium has been investigated. The results obtained with mixtures of 2,2'-bipyridyl and 2-thenoyltrifluoroacetone as organic extractants are summarized. (auth)

Inorganic, Organic, and Physical Chemistry

Chemical and Physicochemical Properties

Refer also to abstracts 12218 and 13697.

11187 DETERMINATION OF THE ADSORPTION ENERGY ON A MASSIVE SOLID BY MEANS OF A LABELLED ADSORBATE. Jacquet, M.; Georges, J. M. (Ecole Centrale Lyonnaise, 69-Ecully (France)). J. Chim. Phys.; 71: No. 11, 1529-1536(Nov 1974). (In French).

It is shown that, thanks to the use of radioactive compounds, which allow quantitative data to be obtained, and thanks to a simplified model of the adsorption process, it is possible to determine the desorption energy of a polar compound adsorbed on a massive solid. This method applied to the study of the adsorption of stearic acid on various metal samples gave results that agree with those obtained on powders by A. J. Groszek and S. G. Daniel. (FR)

11188 PRODUCTION OF SYNTHETIC METHANOL FUEL USING CONTROLLED THERMONUCLEAR FUSION POWER, AIR AND WATER. Steinberg, M.; Dang, V. D. (Brookhaven National Lab., Upton, NY). Trans. Am. Nucl. Soc.; 21: 39-41 (Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11189 COMPLEX FORMATION IN THE SYSTEM MOLYBDENUM(VI)-PYROCATECHOL-OXALATE. Lukachina, V. V. Pilipenko, A. T. Trachevskii, V. V. (Inst. of Organic and Inorganic Chemistry, Kiev). Ukr. Khim. Zh.; 41: No. 4, 416-419(Apr 1975). (In Russian).

Complex formation in the ternary system Mo(VI)-pyrocatechol-oxalate was studied by spectrophotometry, ion exchange, and solvent extraction. At pH 2 to 4 the complex $MoO_2C_2O_4R^{2-}$ with λ_{max} at 410 nm was detected. The complex MoO_2R^0, formed in this pH interval in the absence of oxalate, was extracted by the majority of polar solvents, in contrast to the oxalate-pyrocatechol complex. Mo(VI) bound in the complex $MoO_2C_2O_4R^{2-}$, in contrast to MoO_2R^0, is almost completely non-reducible to the pentavalent state. At pH < 2 and $[H_2C_2O_4] > 0.05$ mol/l, the complex $MoO_2(C_2O_4)_2^{2-}$ dominates in the system. The instability constants of the oxalate and oxalate-pyrocatechol complexes were calculated. These studies were made for the purpose of finding a method for the determination of Mo in the presence of Ta and Ti. (JSR)

Isotope Effects

Refer also to abstracts 11891 and 12519.

11190 A STUDY AS A FUNCTION OF PRESSURE (P < 1,100 BARS) OF THE SPONTANEOUS FREEZING OF DROPLETS OF SUPERCOOLED WATER AND DEUTERATED WATER (VOLUMES OF A FEW mm^3 AND OF A FEW μ^3). Xans, P.; Barnaud, G. (Institut Universitaire de Recherche Scientifique, 64-Pau (France)). Compt. Rend., Ser. A, B; 280: No. 2, 25-27(13 Jan 1975). (In French).

Experiments show that the features of the spontaneous freezing of samples of supercooled water and deuterated water submitted to pressures lower than 1,100 bars are analogous. For both H_2O and D_2O the degree of supercooling ΔT is almost pressure independent for volumes of a few mm^3, while for volumes of a few μ^3 it increases as the pressure increases. (FR)

11191 HYDRODYNAMIC EFFECTS ASSOCIATED WITH BARODIFFUSION. Dandache, H.; Papoular, M. (Centre National de la Recherche Scientifique, 38-Grenoble (France). Centre de Recherches sur les Tres Basses Temperatures). J. Phys. (Paris).; 36: No. 3, 219-223(Mar 1975). (In French).

The pressure-concentration coupling entails some specific dissipation properties in mixtures. Here, two surface effects are considered: sound damping on reflection on a rigid wall and free surface eigenmodes. But through gravity, barodiffusion should also give direct access to an important static quantity: the osmotic compressibility. In isotopic helium mixtures, this would provide an independent determination of the associated tricritical exponent (γ approximately equal to 1). In dilute solutions of ^3He in ^4He, a large osmotic compressibility is predicted, the behavior of which as a function of pressure and temperature, is linked to the effective $^3He-^3He$ interaction. (FR)

11192 NUCLEAR MAGNETIC RESONANCE OF THE BH AND CH PROTONS OF ORTHO AND METACARBORANES IN SOLUTIONS. Selim, M.; Freymann, R. (Paris-6 Univ., 75 (France)); Bartet, B.; Mathey, F. (Institut National de Recherche Chimique Appliquee (IRCHA), 91-Vert-le-Petit (France)); Rabilloud, G.; Sillion, B. (Institut Francais du Petrole (IFP), Centre d'Etudes Nucleaires de Grenoble, 38. Dept. de Recherche). Compt. Rend., Ser. A, B; 279: No. 25, 593-595(16 Dec 1974). (In French).

Observation and assignment of the NMR lines of the BH and CH protons of carboranes in solutions are reported. The C_6D_6, CCl_4, $CDCl_3$, $(CD_3)_2CO$ or $(CD_3)_2SO$ solvent effect is conventional for CH but anomalous for BH. (FR)

11193 ISOTOPE EFFECT IN THE KNIGHT SHIFT OF SILVER. Sahm, W.; Schwenk, A. (Tuebingen Univ. (F. R. Germany). Physikalisches Inst.). Phys. Lett., A; 51: No. 6, 357-358(7 Apr 1975).

The Knight shifts of the silver isotopes ^{107}Ag and ^{109}Ag were determined with high accuracy. Between these shifts there is a difference $\Delta K = K^{107} - K^{109} = -(17.1 \pm 1.1)$ ppm. The relative isotope effect $\Delta K/K$ is not in agreement with the hyperfine structure anomaly $^{107}\Delta^{109}$. (auth)

11194 KINETIC ISOTOPE EFFECT IN THE HOMOLYTIC ABSTRACTION OF BENZYLIC BY TERT-BUTOXY RADICAL. Larson, G. F.; Gilliom, R. D. (Southwestern Univ., Memphis). J. Am. Chem. Soc.; 97: No. 12, 3444-3447(11 Jun 1975).

The kinetic effect for the abstraction of hydrogen (deuterium) from toluene by tert-butoxy radical derived from tert-butyl hypochlorite has been determined as a function of temperature. The determinations were made under conditions eliminating chlorine atom chains. The curved Arrhenius-type plot that is observed is discussed in terms of tunneling. (auth)

11195 DYNAMIC INTERLIGAND HYDROGEN TRANSFER IN SOME ETA^5-CYCLOPENTADIENYLZIRCONIUM AND -HAFNIUM TETRAHYDROBORATES. Marks, T. J.; Kolb, J. R. (Northwestern Univ., Evanston, IL). J. Am. Chem. Soc.; 97: No. 12, 3397-3401(11 Jun 1975).

The compounds $(eta^5\text{-}C_5H_5)_2Zr(BH_4)_2$, $(eta^5\text{-}C_5H_5)_2Hf(BH_4)_2$, and $(eta^5\text{-}C_5H_5)_2Zr(H)BH_4$ exhibit exchange of C_5H_5 and BH_4 hydrogens which is rapid on the proton NMR time scale at elevated temperatures. The process is found to be predominantly unimolecular, with with free energies of activation (DELTA $G^{\ddagger}$) for the above compounds of 21.3 +- 0.4, 19.4 +- 0.4, and 19.6 +- 0.4 kcal/mol (395^{0}K), respectively. For $(C_5H_5)_2Zr(H)BH_4$, the hydrido hydrogen also appears to become involved in the exchange process at higher temperatures, with DELTA $G^{\ddagger}$ equals 20.9 +- 0.5 kcal/mol (395^{0}K). The interchange process also occurs for $(C_5H_5)_2Zr(BD_4)_2$ in the solid state, but more slowly. The possible mechanisms of this prototropic rearrangement are discussed, and the likely importance of eta^1-C_5H_4M carbene-ylid complexes along the reaction coordinate is underscored. (auth)

11196 THERMAL TRANSCARBOXYLATION REACTIONS. V. Study of the Relative Reactivities of the Aromatic Hydrogens in the Thermal Transformation of Potassium Benzoate. Szammer, J. (Central Research Inst. for Chemistry, Budapest). Acta Chim. Acad. Sci. Hung.; 85: No. 1, 97-105(1975).

The relative rate of abstraction of the o-, m- and p-hydrogens in the thermal transformation of potassium benzoate was studied with the use of compounds specifically labelled with deuterium. It was found that the reactivity of the hydrogens of the aromatic ring exhibits the position-dependence o-H > m-H > p-H, the extent of which is more significant for the reaction occurring in the solid phase than for that in the melt. (auth)

11197 VIBRATION-ROTATION BANDS OF ISOTOPIC FORMS OF N_2O IN THE REGION AT 4.5 μm. Blanquet, G.; Walrand, J.; Courtoy, C. P. (Facultes Notre-Dame de la Paix, Brussels). Ann. Soc. Sci. Brux. Ser. I; 89: No. 1, 93-114(20 Mar 1975). (In French).

With the use of a grating spectrometer, the high resolution infrared spectrum of N_2O was studied in the region at 4.5 μm. The ν_3 band was analyzed for five isotopic forms. Three hot bands were also observed for $^{14}N^{15}N^{16}O$ and $^{14}N^{14}N^{18}O$. (tr-auth)

11198 KINETIC ISOTOPE EFFECTS FOR NITROALKANES AND THEIR RELATIONSHIP TO TRANSITION-STATE STRUC-

TURE IN PROTON-TRANSFER REACTIONS. Bordwell, F. G.; Boyle, W. J. Jr. (Northwestern Univ., Evanston, IL). J. Am. Chem. Soc.; 97: No. 12, 3447-3452(11 Jun 1975).

Primary isotope effects, k/sup H//k/sup D/, have been determined for 1-phenylnitroethane and six of its meta substituted derivatives (pK/sub a/'s 6.0 to 7.5) with hydroxide ion, piperidine, diethylamine, and piperazine in water at 25°. A small increase in the ratio (from 7.2 to 9.6) was observed as DELTApK changed from -8.6 to -2.5. A secondary isotope effect of about 15 percent was observed for $PhCH_2NO_2$. A plot of log k/sup H//k/sup D/ vs. DELTApK using ten of these points and nine literature values gave a bell-shaped curve with gently sloping sides. Solvent isotope effects, k/sup DO^-//k/sup HO^-/, were found to range around 1.35 for the parent, m-CH_3-, and m-ClArCHMeNO_2 compounds. Comparison of these values with those of other carbon acids showed that this ratio varied but little over wide ranges of DELTApK. In exoenergetic deprotonations, the k/sup H//k/sup D/ ratio and Bronsted coefficient are larger than expected for a reactant-like transition state while, for endoenergetic reactions, the effect of methyl substitution is generally to retard the deprotonation rate instead of accelerate it, as would be expected for a product-like transition state. These effects can be rationalized, however, by assuming a two-step mechanism, a rate-limiting deprotonation to form a pyramidal nitro carbanion followed by a rapid rehybridization to a planar nitronate ion. This mechanism also can accommodate inverse Bronsted correlations and Bronsted coefficients larger than one. (auth)

Isotope Exchange and Isotope Separation

11199 ISOTOPE SEPARATION PROCESS FOR THE CONCURRENT PRODUCTION OF ^{6}Li AND DEUTERIUM. Valfells, A. (Iowa State Univ., Ames). Trans. Am. Nucl. Soc.; 21: 38-39 (Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11200 ONIUM IONS. XVI. Hydrogen–Deuterium Exchange Accompanying the Cleavage of Ammonium (Tetradeuterioammonium) Trifluoroacetate by Lithium Deuteride (Hydride) Indicating Sn2 Like Nucleophilic Displacement at Quaternary Nitrogen Through Pentacoordinated NH_5. Olah, G. A.; Donovan, D. J.; Shen, J.; Klopman, G. (Case Western Reserve Univ., Cleveland). J. Am. Chem. Soc.; 97: No. 12, 3559-3561(11 Jun 1975).

The reactions of ammonium trifluoroacetate and lithium hydride, of ammonium trifluoroacetate and lithium deuteride, and of tetradeuteroammonium trifluoroacetate and lithium hydride were studied in an attempt to prove experimentally nucleophilic displacement through the formation of pentacoordinated NH_5. Significant isotopic scramblings were observed in the reaction products. An analysis of possible side reactions indicated that the most reasonable explanation for the reaction products obtained is the attack of D^- on the quarternary hydrogen of NH_4^+ in an SN2-like fashion causing exchange to occur via pentacoordinated NH_4D. The possibility of a real pentacoordinated intermediate was also considered. CNDO/2 calculations show that a nucleophilic attack on hydrogen is favored, but the alternative attack on nitrogen can not be dismissed because of the experimental data. The reaction of $NF_4^+SbF_6^-$ and LiF could indicate the possibility of nucleophilic attack on nitrogen. (JSR)

11201 CIS LABILIZATION OF LIGAND DISSOCIATION. I. ^{13}CO EXCHANGE AND PHOSPHORUS LIGAND SUBSTITUTION WITH $Mn(CO)_5Br$ AND $Re(CO)_5Br$. Atwood, J. D.; Brown, T. L. (Univ. of Illinois, Urbana). J. Am. Chem. Soc.; 97: No. 12, 3380-3385(11 Jun 1975).

The exchange of ^{13}CO with $Mn(CO)_5Br$ and $Re(CO)_5Br$ in hexane has been measured using infrared spectral techniques. A complete accounting of the time dependencies of all isotopically labeled species and comparison with the results of phosphorus ligand substitution rates lead to the following conclusions. (a) The rate-determining process is CO dissociation. (b) The rate constant for cis CO dissociation is at least ten times that for trans. (c) The five-coordinate intermediate formed in the dissociation is fluxional. (d) The rate constant for cis CO dissociation in $Mn(CO)_5Br$ is 2.8×10^{-5} sec^{-1} at 23°; for $Re(CO)_5Br$ at 30°, 5.1×10^{-7} sec^{-1}. The labilization of CO toward dissociation by cis ligands which are weaker pi acceptors than CO seems general. (auth)

11202 HYDROGEN ISOTOPE FRACTIONATION BETWEEN HCl_2^--ION AND HCl. Szydlowski, J. (Warsaw Univ. (Poland). Lab. of Radiochemistry and Radiation Chemistry). Z. Naturforsch., A; 30: No. 1, 38-43(Jan 1975).

Hydrogen isotope fractionation between hydrogen dichloride ion in the condensed phase and gaseous hydrogen chloride was studied both theoretically and experimentally. Quite good agreement between the experimental tritium fractionation factor and that theoretically calculated for two sets of vibrational data was found. Theoretical calculations of the fractionation factors of both deuterium and tritium over the large temperature range of 100-2,000°K revealed some anomalies (minima and crossover points) in their temperature dependences. The relative tritium-deuterium isotope effect is also discussed within the framework of the presently accepted statistical-thermodynamic theory in the harmonic approximation and recent works by Stern et al. (auth)

11203 METHOD FOR THE SEPARATION OF ISOTOPES. Jepson, B. E. (to USAEC, Washington, D. C. to US Energy Research and Development Administration). German(FRG) Patent 2,401,590/S/. 1 Aug 1974. 21p. (In German).

The basis of the method for chemical enrichment of isotopes is the preferential formation of a complex of the lighter isotope in an isotope mixture with a macrocyclic polyether. The cyclic polyether complex is then extracted with an organic solvent from which, finally, the isotope can be separated. A constant back-flow system allows a continuous counter-current liquid/liquid extraction. The separation of $^{40}Ca/^{44}Ca$ is described as an example of application of the procedure. Here, a one-step separation factor alpha of at least 1.004 can be reached. However, the method is applicable to quite a number of elements when different cyclic polyethers are used. (GE)

11204 CONVENIENT SYNTHESIS OF PROTIATED AND SPECIFICALLY DEUTERATED SECONDARY AZOALKANES. Grizzle, P. L.; Miller, D. W.; Scheppele, S. E. (Oklahoma State Univ., Stillwater). J. Org. Chem.; 40: No. 13, 1902-1906(27 Jun 1975).

A convenient synthesis of secondary azo compounds is reported. The method involves addition of chlorine to the azine or hydrazone in CH_2Cl_2 followed by reduction of the dichloro- or chloroazoalkane with $LiAlH_4$ or $LiAlD_4$ in ether. The preparation of a variety of symmetrical secondary azoalkanes demonstrates the applicability of the technique. The procedure is applicable to the synthesis of (sec-alkylazo)alkanes and presumably of (sec-alkylazo)-2,4,6-trichlorobenzenes. The isotope purity of the azoalkane is fixed by that of the azine or hydrazone precursor and of the $LiAlD_4$. (auth)

Feed Materials Processing

Refer also to abstract 11256.

11205 STUDY OF ADU PRECIPITATION CONDITIONS. Steeper, T. J. (E. I. du Pont de Nemours and Co., Aiken, SC); Zink, J. C. Trans. Am. Nucl. Soc.; 21: 181-182(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting, New Orleans, LA (8 Jun 1975).

11206 IMPROVED PROCESS OF URANIUM PRODUCTION FROM PHOSPHATE. Huber, H. Atomwirtsch., Atomtech.; 20: No. 3, 127-128(Mar 1975). (In German).

Many thousands of tons of uranium annually have so far been lost by the phosphate acid industry because the 0.01 to 0.02% of uranium oxide contained in crude phosphates were not extracted. Technical progress has been made in a special recovery process successfully tested on a pilot plant scale by two U. S. companies. Crude phosphoric acid is neutralized with ammonia in a self-heating process in the autoclave at elevated temperatures up to the monoammonium phosphate stage. The neutralized neutralizing sludge, which can be filtered, is separated. Monoammonium phosphate crystallizes out of the filtrate as a product of technical purity, with water evaporating in the process. The uranium of phosphoric acid remains in solution and is precipitated by reduction in the mother liquor of the crystallization. (auth)

Radiation Chemistry

Refer also to abstracts 11684, 11687, and 12190.

11207 (NP-20478) TREATMENT OF POLLUTANTS WITH IONIZING RADIATIONS. A Bibliography. Van Den Broeck, P. J. (Comp.). (Institut National des Radioelements, Brussels (Belgium)). Dec 1974. 29p. Dep. NTIS (US Sales only) $4.50.

A review is given of abstracts taken from literature covering the period 1970-1974 and concerning the destruction and removal of impurities and microorganisms in waste waters and sludges, the destruction and removal of poisonous elements in gases, and destruction of plastic wastes. The bibliographic sources used were Chemical Abstracts, Nuclear Science Abstracts, INIS Atomindex, and La Propriété Industrielle Nucléaire (BREVATOME).

References 3 and 19 give information about the period 1948-1970. (89 references) (auth)

11208 (ORO-4059-5) RADIATION CHEMISTRY OF HIGH POLYMERS. Progress Report No. 5, 1 May 1974–1 May 1975. Dole, M.; Welch, R. A. (Baylor Univ., Waco, Tex. (USA)). 20 May 1975. Contract AT(40-1)-4059. 9p. Dep. NTIS $4.00.

The influence of polyethylene morphology on free radical production and decay was studied. Hydrogenated polyethylene, single crystal mats, and extended chain samples of polyethylene were irradiated. Alkyl radical G values for 77°K gamma irradiations are given. (LK)

11209 (RFP-2298) RADIATION EFFECTS ON ION-EXCHANGE RESINS. Part III. Alpha Irradiation of Dowex 50W. Kazanjian, A. R.; Horrell, D. R. (Dow Chemical U.S.A., Golden, Colo. Rocky Flats Div.). 2 Jun 1975. Contract AT(29-1)-1106. 7p. Dep. NTIS $4.00.

Dowex R circle 50W cation exchange resin was irradiated with alpha particles by allowing americium-241 to remain sorbed on the resin for various periods. Measurements of exchange capacity on a dry-weight basis showed a decrease of about 20 percent after an absorbed dose of 3×10^8 rads. The moisture content of resin loaded with americium 241 to full capacity increased from 66.5 to about 70 percent, whereas the moisture content of resin loaded to 10 percent of its capacity increased to greater than 90 percent. (auth)

11210 A DIRECT EFFECT OF IONIZING RADIATIONS ON PERCHLORIC ACID. Ferradini, C.; Pucheault, J.; Julien, R. (Centre National de la Recherche Scientifique, 94–Ivry-sur-Seine (France)); Gilles, L.; Lesigne, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91–Gif-sur-Yvette (France). Section des Recherches et de l'Interaction du Rayonnement avec la Matiere). J. Chim. Phys.; 72: No. 1, 121-122(Jan 1975). (In French).

The absorption spectrum of aqueous perchloric solutions irradiated by a single pulse of 8 ns shows, for $(HClO_4)$ = 11.2 and 11.7 M, a maximum at 410 nm, attributed to ClO_3, and a shoulder around 280 nm. (FR)

11211 CHEMICAL METHODS FOR IDENTIFICATION AND ESTIMATION OF FREE RADICALS. Dechaux, J. C. (Lille-1 Univ., 59–Villeneuve-d'Ascq (France)). Bull. Soc. Chim. Fr.; No. 12, 2801-2810(Dec 1974). (In French).

A review was made of the chemical methods of estimating free radicals. In the gaseous phase, there exist methods using mirrors, those not using mirrors, and those employing radiochemistry. For the liquid phase, a wider range of procedures were developed, utilizing a large variety of free radical trapping reagents. Very little work has been carried out in the solid phase. In general, all these methods suffer from the same difficulty, that of avoiding the perturbation effect as a result of introducing the trapping reagent into the system. These methods are complementary to physical methods, which present other disadvantages. (FR)

11212 THE GAMMA RADIOLYSIS OF POTASSIUM PERBROMATE IN AQUEOUS SOLUTIONS. Hassan, N.; Heitz, C. (Centre National de la Recherche Scientifique, 67–Strasbourg (France). Lab. de Chimie Nucleaire). J. Chim. Phys.; 72: No. 1, 117-119 (Jan 1975). (In French).

The radiolytic reduction of potassium perbromate in aerated and deaerated aqueous solutions was investigated. Dose rate and pH dependence were examined. In acidic medium G(indirect) $(-BrO_4^-)$ = 3.5. In a neutral solution, BrO_4^- is reduced by the solvated electron. However G(indirect) $(-BrO_4^-)$ = 5.3 indicates that other species are involved in the reduction process. (FR)

11213 INFLUENCE OF WATER IN THE RADIATION-INDUCED POLYMERIZATION OF METHACRYLIC ACID. Gouloubandi, R.; Chapiro, A. (Teheran Univ. Nuclear Centre (Iran); Centre National de la Recherche Scientifique, 92–Meudon-Bellevue (France). Lab. de Chimie Macromoleculaire sous Rayonnement). C. R., Ser. C.; 280: No. 5, 345-348(10 Feb 1975). (In French).

The polymerization of methacrylic acid in aqueous solution follows complex kinetics. With the pure monomer and concentrated solutions the conversion curves are practically linear. When the mole fraction of the monomer decreases below 0.55, auto-accelerated conversion curves occur. The rate exhibits a maximum for monomer mole fractions of 0.45 to 0.55. Polymerization takes place in precipitating medium in the pure monomer and in solutions containing more than 33% monomer, while in more diluted solutions the mixture remains homogeneous. The change in the shape of the kinetic curves and the increase in rate upon addition of water seem to result partly from the change in reaction medium, but the auto-acceleration could also follow from a matrix effect involving the poly(methacrylic acid) produced in the initial stage of the reaction. (FR)

11214 SPECTROPHOTOMETRIC STUDIES OF THE RADIOLYTIC REDUCTION $Cu^{2+} \rightarrow Cu^{+}$ IN LIQUID AMMONIA. Delcourt, M. O.; Saito, Eichi (Paris-11 Univ., 91–Orsay (France). Lab. de Physico-Chimie des Rayonnements; CEA Centre d'Etudes Nucleaires de Saclay, 91–Gif-sur-Yvette (France). Dept. de Recherche et Analyse). C. R., Ser. C.; 280: No. 10, 613-615 (10 Mar 1975). (In French).

Optical absorption spectra of Cu^{2+} ions as well as those of Cu^{+} ions radiolytically produced, were obtained in liquid ammonia between −60 and 20°C. (FR)

11215 INCREASED RADIATION DEGRADATION IN METHYL METHACRYLATE COPOLYMERS. Helbert, J. N.; Wagner, G. E.; Caplan, P. J.; Poindexter, E. H. (Army Electronics Technology and Devices Lab., Fort Monmouth, NJ). J. Appl. Polym. Sci.; 19: No. 4, 1201-1203(Apr 1975).

The effect of polar substituents at the quaternary carbon on degradation processes in several polymers and 10 to 20 percent copolymers of methyl methacrylate was explored. EPR was used to monitor radiation degradation products and to determine radiation G values. Irradiations were carried out at 77°K in a gamma irradiator at a dose rate of 0.3 Mrad/hr. (LK)

11216 ESR STUDY OF RADICALS PRODUCED BY IRRADIATION OF HETEROGENEOUS POLYMERIC SYSTEMS. Nikitin, L. Ya.; Fedoseeva, T. S.; Kuz'minskii, A. S. (Scientific-Research Inst. of the Rubber Industry, Moscow). High Energy Chem.; 8: No. 6, 484-485(1974).

Translated from Khim. Vys. Energ.; 8: No. 6, 557-558(1974).

A study was made of the structure and properties of the radicals formed by the low-temperature γ radiolysis of SKF-26 fluoroelastomer to which was grafted an oligoesteracrylate in the form of TMGP-11 [tetramethacrylate (bis-glycerophthalate)]. Results from the study established the presence of a two-phase system and qualitatively characterized the mobility in each of the phases. (LK)

11217 CONTRIBUTION TO THE THEORY OF THE RADIATION-CHEMICAL INITIATION OF CHAIN REACTIONS. Tal'roze, V. L. (Inst. of Chemical Physics, Moscow). High Energy Chem.; 8: No. 6, 445-452(1974).

Translated from Khim. Vys. Energ.; 8: No. 6, 519-527(1974).

A general theory of the radiolytic initiation of chain processes is presented which makes it possible, on the basis of known kinetic parameters, to predict the range of dose rates and temperatures in which radiation initiation is significantly greater than thermal initiation. The theory leads to a number of practical recommendations on the use of various types of radiation sources for initiating chain reactions. (auth)

11218 RADIOLUMINESCENCE AND ESR STUDIES OF $CaSO_4 \cdot Mn$ RADIOPHOSPHORS. Gromov, V. V.; Ivanov, L. N.; Karelin, V. V.; Saunin, E. I. (Inst. of Physical Chemistry, Moscow). High Energy Chem.; 8: No. 6, 478-479(1974).

Translated from Khim. Vys. Energ.; 8: No. 6, 553-554(1974).

The radioluminescence and microwave spectroscopic properties of $CaSO_4 \cdot Mn$ labeled with ^{35}S were investigated to explain why in an earlier study radioluminescence in the Mn^{2+} band was observed to increase in intensity, with subsequent stabilization and gradual decrease as the radioactive isotope decayed. The study tested the hypothesis that the increase was caused by a rise in the number of defects in the crystalline lattice in the form of recombination centers, from which there occurs a resonance transfer of energy to Mn^{2+} ions. (LK)

11219 FORMATION OF ClO_4 AND ClO_3^{2-} RADICALS BY IRRADIATION OF POTASSIUM PERCHLORATE IN THE PRESENCE OF ALUMINUM OXIDE. Nevostruev, V. A.; Pak, V.; Sizikov, A. M.; Zakharov, Yu. A. (Tomsk Polytechnical Inst., USSR). High Energy Chem.; 8: No. 6, 480-481(1974).

Translated from Khim. Vys. Energ.; 8: No. 6, 554-555(1974).

The aim of the present work was to obtain direct proof of the occurrence, and to establish the direction, of charge transfer across the separation boundary during the irradiation of the heterogeneous $KClO_4-Al_2O_3$ system. Single crystals of $KClO_4$ mixed with powdered $\alpha-Al_2O_3$ were irradiated with 1.5 MeV electrons. (LK)

11220 TRACK STRUCTURE OF A MULTIPLY CHARGED ION. Miterev, A. M.; Kaplan, I. G.; Borisov, E. A. (Physical Chemistry Inst., Moscow). High Energy Chem.; 8: No. 6, 461-465(1974).

Translated from Khim. Vys. Energ.; 8: No. 6, 537-542(1974).

The track of a nuclear fuel fission fragment in a liquid was examined theoretically. According to the results, the track of a multiply charged ion can be represented by a cylindrical ionic core of about 7 Å diameter, surrounded by a conical (converging to the end of the track) region of excitations and ionizations formed directly by the ion and also by secondary electrons. Equations

were obtained representing the distribution of primary active particles in the track. (auth)

11221 EFFECT OF NEUTRON IRRADIATION ON THE ADSORPTIVE CAPACITY OF SILICA GEL. Sutyagin, V. A. (Physical Chemistry Inst., Moscow). High Energy Chem.; 8: No. 6, 466-468(1974).

Translated from Khim. Vys. Energ.; 8: No. 6, 543-546(1974).

The effect of irradiation by fast neutrons of average energy 1 MeV on the capacity of silica gel to adsorb ammonia was investigated. After irradiation with an integral neutron flux greater than 10^{16} neutrons/cm^2 the adsorptive capacity increases to a level which is maintained even after heating the irradiated sample to 400-450°C. A correlation was noted between the number of additionally adsorbed molecules and the number of displacement-type defects (vacancies, interstitial atoms) on the sorbent surface. (auth)

11222 RADIOLYSIS OF SOME SYSTEMS CONTAINING ALDEHYDES. II. Formation of Secondary Alcohols in the Radiolysis of Solutions of Propionaldehyde in Methanol. Kalyazin, E. P.; Petryaev, E. P.; Shadyro, O. I. (Belorussian State Univ., Minsk). High Energy Chem.; 8: No. 6, 469-470(1974).

Translated from Khim. Vys. Energ.; 8: No. 6, 547(1974).

Oxygen-free solutions of propionaldehyde in methanol, at concentrations of 1, 2, and 4 M, were irradiated at 120°C to doses of 5×10^{18} to 4×10^{19} ev/g at a dose rate of 60 rads/sec from an LMB-γ-1M radiation source. The results show that secondary alcohols are formed in addition to decarbonylation products during the radiolysis of aldehydes. (LK)

11223 RADIOLYSIS OF SOME SYSTEMS CONTAINING ALDEHYDES. III. Effect of γ-Radiation on Deaerated Aqueous Solutions of Acetaldehyde. Kalyazin, E. P.; Petryaev, E. P.; Kaputskaya, O. F.; Shadyro, O. I. (Belorussian State Univ., Minsk). High Energy Chem.; 8: No. 6, 471-473(1974).

Translated from Khim. Vys. Energ.; 8: No. 6, 548-549(1974).

The gamma radiolysis of deaerated aqueous solutions of acetaldehyde in the concentration range 0.5-4 M was studied at various temperatures. From the studies of the effect of gamma radiation on aqueous solutions of acetaldehyde it is apparent that qualitatively different products are formed from the free and hydrated forms of the aldehyde. (LK)

11224 TRANSIENT EFFECT OF ELECTRIC FIELD ON RADIATION-INDUCED CHARGE CARRIERS. Chandrasekaran, T. (Bechtel Corp., San Francisco); Silverman, J. Trans. Am. Nucl. Soc.; 21: 133(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11225 STUDY OF PROTON RADIATION EFFECTS IN SEVERAL IRON COMPOUNDS USING THE MOESSBAUER TECHNIQUE. Kopcewicz, M.; Kotlicki, A. (Univ., Warsaw). Radiat. Eff.; 24: No. 4, 267-271(Mar 1975).

Experiments are described whereby, using Moessbauer spectroscopy, it is possible to understand better the general radiation effects and chemical changes induced by proton bombardment of potassium ferro- and ferricyanides. The method permits the observation of a superparamagnetic behavior of the magnetic material formed during irradiation. (auth)

11226 LOCALIZED ELECTRONS IN THE PULSE RADIOLYSIS OF Al_2O_3 SINGLE CRYSTALS DOPED WITH 0.05 ATOM % Cr. Vinogradov, G. A.; Shubin, V. N. (Inst. of Electrochemistry, Moscow). High Energy Chem.; 8: No. 6, 453-455(1974).

Translated from Khim. Vys. Energ.; 8: No. 6, 528-531(1974).

The optical absorption spectra and short-lived electrical conductivity induced by a single electron pulse in Al_2O_3 single crystals doped with 0.05 atom % Cr were studied. It was found that an increase in sample temperature leads to a change in band shape and the appearance of electrical conductivity at $T \geq 673$°K. It is suggested that this is connected with the localization of a proportion of the nonequilibrium charges on point defects formed during high-temperature annealing. (auth)

11227 LOW-TEMPERATURE EXOELECTRON EMISSION FROM THE SURFACES OF IRRADIATED OXIDES. II. Magnesium Oxide. Effect of Residual Gases. Dolidze, G. M.; Kolbanovskii, Yu. A.; Polak, L. S.; Sakvarelidze, V. S. (Inst. of Petrochemical Synthesis, Moscow). High Energy Chem.; 8: No. 6, 456-460(1974).

Translated from Khim. Vys. Energ.; 8: No. 6, 532-536(1974).

Exoelectron emission (EEE) from the surface of irradiated magnesium oxide was studied over the temperature range 130-175°K. Results were obtained on the dependence of EEE on the radiation dose and dose rate, on the regime of preliminary ageing in air, on the temperature of ageing in vacuum at 10^{-7} torr, and on the sample temperature during irradiation. A connection was found between one of the EEE peaks and the presence of residual gases at 10^{-7} torr. Values were calculated for the activation energy and pre-exponential factors of each of the thermally stimulated EEE peaks. (auth)

11228 INVESTIGATION OF γ-RAY INDUCED POLYMER FORMATION IN THE CARBORANES. VI. Phase Effects in the Oligomerization of 1-Allyl-O-Carborane. Klingen, T. J.; Hepburn, D. R. (Univ. of Mississippi, University). J. Inorg. Nucl. Chem.; 37: No. 6, 1343-1346(Jun 1975).

The primary concern of this investigation is the effect of the physical state of the monomer on the electron radiolysis of 1-allyl-1, 2-dicarba-closo-dodecaborane-11, 1-allyl-o-carborane. Activation energies for the liquid state radiolysis have been determined as 5 kcal/mole for formation of the oligomer and O kcal/mole for formation of the unsaturated dimers. Negative activation energies have been observed for the plastic crystalline phases of 1-allyl-o-carborane indicating a complex set of reactions are involved. The effects of lattice constraints and diffusion controlled processes in the plastic crystalline phases are discussed. (auth)

11229 HOT MELT COMPOSITIONS PRODUCED BY IRRADIATING ETHYLENE COPOLYMERS IN THE PRESENCE OF WAX. Domine, J. D.; Schaufelberger, R. H. (to Union Carbide Corp.). US Patent 3,884,786. 20 May 1975. Filed date 2 Oct 1973. 8p.

Hot melt compositions were produced by preparing a concentrate of wax and copolymer, irradiating the concentrate to produce an irradiated concentrate, and then diluting the irradiated concentrate with additional quantities of wax to obtain the hot melt composition. The improved three-step method permits the incorporation of copolymers having higher molecular weights in the hot melt composition; it was also found that the copolymers are more readily dissolved in the wax. The copolymers used are the ethylene-vinyl acrylate and ethylene-alkyl acrylate copolymers. (auth)

11230 PROTONATION RATE CONSTANTS AND OPTICAL ABSORPTION SPECTRA OF BENZYL CARBANION PAIRS IN TETRAHYDROFURAN SOLUTION. Bockrath, B.; Dorfman, L. M. (Ohio State Univ., Columbus). J. Am. Chem. Soc.; 97: No. 12, 3307-3313(11 Jun 1975).

The benzyl carbanion paired with lithium cation and with tetrabutylammonium ion has been formed in tetrahydrofuran solution and investigated by the pulse radiolysis method. Absolute rate constants for the protonation of both of these species by methanol and by tert-butyl alcohol have been determined. These data, and previous data for benzyl sodium, show that the ion paired species is more reactive, in these protonations, than is the free carbanion. The optical absorption spectra of both $PhCH_2^-Li^+$ and $PhCH_2^-NBu_4^+$ were determined. The latter exhibits a band maximum at 342 nm, the former, in agreement with data from equilibrium studies, at 330 nm. The effect of ion pairing upon the absorption spectrum of $PhCH_2^-$ by Li^+, Na^+, and NBu_4^+ is shown. (auth)

11231 FREE-RADICAL INTERMEDIATES PRODUCED FROM THE ONE-ELECTRON REDUCTION OF PURINE, ADENINE, AND GUANINE DERIVATIVES IN WATER. Moorthy, P. N.; Hayon, E. (Army Natick Labs., MA). J. Am. Chem. Soc.; 97: No. 12, 3345-3350(11 Jun 1975).

The one-electron reduction of purine (PH), 9-methylpurine (MP), adenosine (A) and 1-methylguanosine (MG) in water was studied using the fast-reaction technique of pulse radiolysis and kinetic absorption spectrophotometry. The hydrated electron, e^-/sub aq/, and the acetone ketyl radical, $(CH_3)_2COH$, were used as the reducing agents. The reaction rate constants of the purine derivatives with e^-/sub aq/ and the $(CH_3)_2COH$ radical were determined at different pH values, consistent with the pK/sub a/ values of these compounds. The rate constants with e^-/sub aq/ were close to the diffusion-controlled limit, k equal to or less than 2.0×10^{10} M^{-1} sec^{-1}. The electron transfer reaction from $(CH_3)_2COH$ was found to be strongly dependent on the acid-base properties of the purines and on the nature of the substituents. A correlation between the reaction rate constants with $(CH_3)_2COH$ and the redox potential of the purines is suggested. The transient optical absorption spectra of the free-radical intermediates produced from the reduction of the purine derivatives were determined over the pH range 0 to 14. The extinction coefficients and decay kinetics are also presented. These radicals undergo acid-base dissociation reactions. The pK/sub a/ values for the purine radicals PH_3^{2+}, PH_2^+, PH_2, and PH^- are 3.2 +- 0.1, 8.5 +- 0.2, 9.9 +- 0.2, and 12.5 +- 0.2, respectively. For 9-methylpurine, the MPH_3^{2+}, MPH_2^+, and $MPH^\cdot$ radicals have pK/sub a/ values of 2.9 +- 0.2, 6.3 +- 0.1, and 13.1 +- 0.2, respectively. For adenosine, the AH_3^{2+} and AH_2^+ radicals have pK/sub a/ values of 4.6 +- 0.1 and 10.5 +- 0.1, respectively, while the ionization of $AH^\cdot$ is not

observed up to pH 13.6. For 1-methylguanosine, two pK/sub a/ (radical) values of approximately 7.0 and equal to or greater than 13.0 are observed. These and other results are discussed, and tentative assignments are suggested for the various radical intermediates. (auth)

11232 THERMOLUMINESCENCE OF POLYMERS. Knappe, W.; Voight, G.; Zyball, A. (Deutsches Kunststoff-Institut, Darmstadt (F. R. Germany)). Kolloid-Z. Z. Polym.; 252: No. 9, 673-679(1974). (In German).

From spring meeting Wuerzburg 1974 on deformation and yield in high-polymer solutions, melts and solids; Wuerzburg, F. R. Germany (18 Mar 1974).

Experimental results of thermoluminescence of different polymethacrylates, polyisobutylene, and polybutadiene are reported. These results are compared with data obtained by other measuring methods. In case of polymethacrylates the glow peak is associated with the rotational movement of the methyl groups attached directly to the main chains. In case of polyisobutylene and polybutadiene a peak is observed in the glass transition range. For polymethacrylates the glow peak may be described by the Arrhenius equation and for the other materials by the WLF equation. (auth)

11233 RADIOLYSIS OF CYCLOHEXANE-HEXAMETHYLBENZENE MIXTURES. I. Pure Substances. Roder, M. (Central Research Inst. for Physics, Budapest). Acta Chim. Acad. Sci. Hung.; 85: No. 1, 55-62(1975).

The ^{60}Co gamma radiolysis of cyclohexane-hexamethylbenzene (HMB) mixtures of different compositions has been investigated in liquid and solid phases. The radiation chemical yields of the main products were determined as a function of the mixture composition and temperature. On the basis of these results it is concluded that HMB exerts a protective effect in cyclohexane decomposition in the liquid phase and this effect can be understood in terms of some kind of physical interaction. (auth)

11234 STUDY OF THE EFFECT OF GAMMA RADIATION ON THE IONIC AND COLLOIDAL SOLUTIONS OF ^{144}Ce(III) AT TRACE CONCENTRATION BY THE METHOD OF SELF-DIFFUSION AND CENTRIFUGATION. Kepak, F.; Teply, J.; Kriva, J. (Inst. of Nuclear Research, Rez, Czech.). Radiochem. Radioanal. Lett.; 21: No. 6, 365-370(16 Jun 1975).

Gamma irradiation of a solution of trace concentration of ^{144}Ce(III) at pH 3.0 causes an increase in the self-diffusion coefficient of ^{144}Ce(III) and small decrease in its centrifugable fraction. The significant increase in the self-diffusion coefficient is observed after irradiation at pH 9.0 and 11.0 and on the centrifugation of these solutions an increased susceptibility of particles containing ^{144}Ce(III) to the coagulation occurs. (auth)

11235 RADIATION YIELD OF HYDROGEN CHLORIDE IN THE POLY(VINYL CHLORIDE) FOILS IRRADIATED BY ACCELERATED ELECTRONS. Szymanski, W.; Smietanska, G. (Nicholas Copernicus Univ., Torun, Poland). J. Appl. Polym. Sci.; 19: No. 7, 1955-1958(Jul 1975).

The G/sub HCl/ values of PVC foils, containing 18 percent of dioctylphthalate, irradiated with accelerated electrons were studied after addition of various amounts of the stabilizers: (I) ethylene glycol bis-beta-aminocrotonate, (II) calcium/zinc laurate + epoxy compounds, (III) calcium/zinc stearate, (IV) dioctyltin bis(octylthioglycolate). The effect of stabilization turned out to be very good, especially when stabilizer I was used. In the case of soft PVC foils in contact with water, elution of hydrogen chloride occurs. This creates difficulties in preparing PVC foils sterilized radiatively for medical purposes, especially if the foils are expected to be in contact with water. (auth)

11236 PHYSICAL STATE OF RADIATION-POLYMERIZED POLYETHYLENE BLENDS. Yamaguchi, K.; Yagi, T.; Machi, S.; Takehisa, M. (Japan Atomic Energy Research Inst., Takasaki). J. Appl. Polym. Sci.; 19: No. 7, 1959-1969(Jul 1975).

The physical state of the blends of radiation-polymerized polyethylene with high-density polyethylene was studied. Only one peak was observed in DSC heating curves of the blends quenched from the melt regardless of each polymer content. In addition, transparency of the high-density polyethylene was improved by melt blending with radiation-polymerized polyethylene. This is a characteristic of high-density polyethylene and radiation-polymerized polyethylene blends different from high-density and low-density polyethylene blends. A new peak and/or a new shoulder, however, appeared in DSC heating curves of the blends with heat treatment at 110°, 120°, and 125°C. These results suggest that the physical state of the blends quenched from the melt is one where the crystallization of the radiation-polymerized polyethylene is highly hindered by the presence of high-density polyethylene. The radiation-polymerized polyethylene may remain mainly in a physical state similar to the melt. The haze value of the blends increased with heat treatment. The increase in the haze is caused by change in physical states, such as growth of spherulites and formation of microcrystals and microvoids, by the heat treatment. (auth)

11237 CHLORINE HEXAFLUORIDE RADICAL. Preparation, Electron Spin Resonance Spectrum, and Structure. Nishikida, K.; Williams, F.; Mamantov, G.; Smyrl, N. (Univ. of Tennessee, Knoxville). J. Am. Chem. Soc.; 97: No. 12, 3526-3527(11 Jun 1975).

The chlorine hexafluoride radical was generated by gamma radiolysis of SF_6 containing 5 mol percent of ClF_5 at -196°. The first-derivative ESR spectrum of solid irradiated SF_6 at -165 is shown. Septet substructures were attributed to hyperfine interactions. ESR parameter calculations indicate that the unpaired electron occupies the a*/sub lg/ orbital in O/sub h/ symmetry. As an alternative to O/sub h/ symmetry, the possibility that ClF_6 undergoes deformations similar to those deduced for XeF_6 is discussed. Reasons for the broadening of the ClF_6 spectral lines are considered. (JSR)

Radiochemistry and Nuclear Chemistry

Properties of Radioactive Materials

Refer also to abstracts 11157, 11160, 11911, 12838, and 13272.

11238 (KFK-2050, pp 245-255) DEVELOPMENT OF DECONTAMINATION PROCEDURES. Hentschel, D.; Kunze, S. Aug 1974. (In German).

In 1st semi-annual report 1974. (Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Nukleare Sicherheit).

The decontamination of stainless steels and nickel base alloys, the development of a decontamination paste, and the decontamination of metallic surfaces with molten salts are described. (GE)

11239 CRYSTAL STRUCTURE OF URANIUM CHROMIUM SULFIDE $CrUS_3$. Noel, H.; Padiou, J.; Prigent, J. (Rennes-1 Univ., 35 (France)). C. R., Ser. C.; 280: No. 3, 123-126(20 Jan 1975). (In French).

Uranium chromium sulfide ($CrUS_3$) crystallizes in the orthorhombic system, space group Pnam. Chromium(II) in (4a) position is octahedrally surrounded by sulfur atoms. Uranium(IV) in (4c) position is in bi-capped trigonal prismatic sites. Atomic positions are given with R = 0.047. (FR)

11240 STUDY OF THE INFRARED ABSORPTION AND RAMAN DIFFUSION SPECTRA OF THE $(UO)_2\ F_9^{3-}$ ION IN THE $K_5(UO_2)_2F_9$ COMPLEX (BINUCLEAR ION CONDENSED BY A SIMPLE FLUORINE LINK). Nguyen Quy Dao; Knidiri, M. (Ecole Centrale des Arts et Manufactures, 92-Chatenay-Malabry (France)). C. R., Ser. C.; 279: No. 25, 1041-1044(16 Dec 1974). (In French).

The Raman diffusion and infrared absorption spectra of the $K_5(UO_2)_2F_9$ compound were investigated in the spectral range 4000-80 cm^{-1}. The fundamental vibrational bands were determined taking into account the condensation of the two $UO_2F_3^{3-}$ ions by a fluorine atom. The normal modes of vibration of the $(UO_2)_2F_9^{3-}$ ion were analyzed and the vibrational spectrum discussed. (FR)

11241 OBSERVATION OF THE ACID BEHAVIOR OF THE OXYTETRAFLUORIDE OF URANIUM IN THE PREPARATION OF OXYPENTAFLUOROURANATES (VI) OF POTASSIUM AND AMMONIUM. Joubert, P.; Bougon, R. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Genie Isotopique; Limoges Univ., 87 (France)). C. R., Ser. C.; 280: No. 4, 193-195(27 Jan 1975). (In French).

The oxytetrafluoride of uranium UOF_4 is a fluoride ion acceptor. This property is shown through the preparation of the oxypentafluorouranates(VI) of potassium and ammonium $KUOF_5$ and NH_4UOF_5. The oxypentafluorouranate ion UOF_5^- is present in these complexes, which are isotype of the corresponding hexafluorouranates(V). From the preliminary experiments UOF_4 is able to react with some other alkaline fluorides or with nitrosyl fluoride. In the latter case, the complexes are unstable and hexafluorouranate(V) $NOUF_6$ is produced by the decomposition. (FR)

11242 A NEW SERIES OF COMPOUNDS WITH A FORMULA $M_5L_4S_{16}$ (M = U, Th; L = Tb, Dy, Y, Ho, Er, Tm, Yb, Lu). Tien, V.; Guittard, M. (Paris-5 Univ., 75 (France). Faculte des Sciences Pharmaceutiques et Biologiques de Paris-Luxembourg). C. R., Ser. C.; 279: No. 20, 849-850(13 Nov 1974). (In French).

The preparation and crystal structure of a new mixed sulfide series with a formula $M_5L_4S_{16}$ (M = U(IV) or Th(IV); L = rare earth metals from Tb to Lu and Y) are described. The unit cell is monoclinic and space groups B2, Bm or B2/m. (FR)

11243 FORMATION OF U(V) DURING THE PHOTODECOMPOSITION OF URANYL FORMATE IN THE SOLID STATE. Claudel, B.; Feve, M.; Puaux, J. P.; Sautereau, H. (Institut National des Sciences Appliquees (INSA), 69-Villeurbanne (France)). C. R., Ser. C.; 280: No. 4, 169-172(27 Jan 1975). (In French).

The formation of U(V) was observed in the photoreduction of the solid uranyl formate monohydrate. The U(V) produced is relatively stable at room temperature; at 85°C this species disappears and gives U(IV) as a final product of the photochemical reduction of the uranyl ion. (FR)

11244 SOME PARTICULAR FEATURES OF ADSORBOLUMINESCENCE OF THORIUM DIOXIDE. Claudel, B. (Centre National de la Recherche Scientifique, 69-Villeurbanne (France). Inst. de Recherches sur la Catalyse); Wolkenstein, T. C. R., Ser. C.; 280: No. 3, 81-84(20 Jan 1975). (In French).

The characteristics of the adsorboluminescence phenomenon observed by Russian and French authors differ in three respects: spectral composition of the emitted light, variation of the luminous intensity as a function of time, and value of this intensity at adsorption-desorption equilibrium. It is shown that these discrepancies can be interpreted in the framework of the general theory of adsorboluminescence. (FR)

11245 SPECTRAL EVIDENCE FOR LANTHANOID AND ACTINOID CARBONYL COMPOUNDS. Sheline, R. K. (Florida State Univ., Tallahassee); Slater, J. L. Angew. Chem. Int. Ed. Engl.; 14: No. 5, 309-313(May 1975).

The co-condensation of actinoid or lanthanoid atoms and a mixture of argon containing small amounts carbon monoxide on a surface cooled with liquid helium leads, after annealing of the argon matrix, to a series of new binary actinoid and lanthanoid carbonyl compounds. Evidence for these new carbonyls is obtained using infrared spectroscopy. Preliminary interpretation of the IR spectra suggests that at least six complexes, $M(CO)_{1-6}$, were observed for each metal. A distinct difference in the infrared spectra is observed for the ytterbium derivative, probably associated with the fact that ytterbium lacks one electron from having entirely filled 4f orbitals. A brief description of the possible bond hybridization and its effect on the M-C-O bonding, which may explain the difference between ytterbium and the other lanthanoids, is presented. (auth)

11246 VALENCE STATES OF ATOMS AND STABILITY PRINCIPLES OF GASEOUS COMPOUNDS OF f ELEMENTS. Charkin, O. P. (Inst. of New Chemical Problems, Moscow). J. Struct. Chem.; 15: No. 6, 879-884(1974).

Translated from Zh. Strukt. Khim.; 15: No. 6, 985-992(1974).

The principles of the variation of the energies of atomization of compounds of the rare-earth elements as a function of the period, the position of the f element in the period, and of its valence are discussed within the framework of the model described earlier. The conclusions of the model are in good correlation with the experimental data. (auth)

11247 PRODUCTION OF CERAMIC-GRADE PLUTONIUM DIOXIDE. Doto, P. C.; Peabody, C. M. (Atlantic Richfield Hanford Co., Richland, WA). Trans. Am. Nucl. Soc.; 21: 246-247(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11248 LARGE-SCALE CONVERSION OF LWR PLUTONIUM TO A SOLID FORM. Williams, A. K.; Sumner, W. B.; Thomas, L. L. (Allied-General Nuclear Services, Barnwell, SC). Trans. Am. Nucl. Soc.; 21: 247(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11249 LABELLING PROPERTIES OF ^{51}Cr IN MONODISPERSE TEFLON PARTICLES. Philipson, K.; Linnman, L.; Hellstroem, P. A.; Camner, P. (Kungliga Karolinska Mediko-Kirurgiska Institutet, Stockholm). Health Phys.; 28: No. 5, 621-622(May 1975).

Results are reported of tests performed on monodisperse Teflon particles labelled with ^{51}Cr administered as $Cr(NO_3)_3$. The particle size, the radioactivities of the particles (in μCi/mg particles), and the mean activity per particle at the time when the specific activity of ^{51}Cr was 200 mCi/mg, for three different samples, are tabulated. Leaching of one or a few percent for the first 4 hours and thereafter at a rate of <1% a day is shown. Activities in percent in supernatants and filters after filtration of the accumulated supernatants through 3 and 0.2 μm silver filters are given. (UK)

11250 THE INTERACTIONS OF URANIUM OXYSULPHIDE WITH THE RARE EARTH OXYSULPHIDES. Komac, M. (Institut Jozef Stefan, Ljubljana (Yugoslavia)); Volavsek, B. (College of Chemistry, Maribor (Yugoslavia)). Z. Naturforsch., B; 30: No. 1, 79-80(Jan 1975).

The reactions of uranium oxysulfide with selected oxysulfides of rare earths (La, Gd, Yb) and Y were investigated. Several new phases, identified as uranium-rare earth oxysulfides, were found. The chemical compositions and lattice constants of those compounds were determined. (auth)

11251 LABELLED AMINO ACIDS AND THEIR DERIVATIVES. VI. Preparation of L-Ornithine[5-^{3}H] and L-Lysine-[6-^{3}H]. Mezo, I. [Semmelweis Univ., Budapest]; Havranek, M.; Teplan, I.; Benes, J.; Tanacs, B. Acta Chim. Acad. Sci. Hung.; 85: No. 2, 201-213(1975).

γ-Cyano-L-α-aminobutyric acid and δ-cyano-L-norvaline were prepared from the appropriate α-tosyl derivatives by means of electrolytic detosylation. Catalytic hydrogenation of γ-cyano-L-α-aminobutyric acid and δ-cyano-L-norvaline yielded L-ornithine and L-lysine, respectively. The reduction was also effected, with sodium borohydride in the presence of Raney nickel. L-ornithine-[5-^{3}H] and L-lysine-[6-^{3}H] were prepared in both ways. Reduction with sodium borotritide was found to be particularly advantageous since it made possible the preparation of compounds with high specific activity. (auth)

11252 STABILITY OF NEPTUNIUM(III) COMPLEXES WITH SOME COMPLEXONS. Krot, N. N.; Mefod'eva, M. P. (Inst. of Physical Chemistry, Moscow). Bull. Acad. Sci. USSR, Div. Chem. Sci.; 23: No. 9, 2052-2054(Sep 1974).

Translated from Izv. Akad. Nauk SSSR, Ser, Khim.; No. 9, 2133-2136(Sep 1974).

A quantitative comparison of the stability of the complexes of neptunium(III) and lanthanides reveals that, in the tendency to complex with the anions of ethylenediaminetetraacetic and diethylenetriaminepentaacetic acids, neptunium(III) occupies an intermediate position between europium and samarium. (auth)

11253 STABILITY AND THERMODYNAMICS IN THE INTERACTION OF THIOGLYCOLIC ACID COMPLEXES WITH Y^{3+}, La^{3+}, Be^{2+}, AND UO_2^{2+}. Grewal, S.; Sekhon, B. S.; Chopra, S. L. (Punjab Agricultural Univ., Ludhiana, India). Thermochim. Acta.; 11: No. 3, 315-321(Mar 1975).

Stepwise stability constants of the complexes of thioglycolic acid with Y^{3+}, La^{3+}, Be^{2+}, and UO_2^{2+} have been determined by the potentiometric technique of Irving and Rossotti in aqueous solution at 25, 35 and 45°C, respectively (μ = 0.065 M). The stability of Y^{3+} and La^{3+} complexes increases whereas it decreases with the increase in temperature in the case of Be^{2+} and UO_2^{2+} complexes. The values of enthalpy changes (ΔH) are positive in the case of Y^{3+} and La^{3+} and negative in the case of Be^{2+} and UO_2^{2+}. The complexes of Y^{3+}, La^{3+} and UO_2^{2+} are entropy stabilized. It has been observed that stabilities vary directly with the increase in the ionic strength of the medium in the case of La^{3+}, Be^{2+}, and UO_2^{2+} complexes. (INIS)

11254 CHROMATOGRAPHIC PURIFICATION OF TRITIATED STEROIDS PRIOR TO USE IN RADIOIMMUNOASSAY. Manlimos, F. S.; Abraham, G. E. (Harbor General Hospital, Torrance, CA). Anal. Lett.; 8: No. 6, 403-410(1975).

The purity of tritiated steroids used as reagents in radioimmunoassay plays an important role in the reliability of the assay. These radioactive reagents should be assessed for purity upon receipt and the purity should be checked periodically afterward. For such purposes, we have used chromatographic purification on Celite microcolumns. By changing the polarity of the stationary and mobile phases, 20 different tritiated steroids with a wide range of polarity could be purified on these microcolumns. This approach is easy, rapid, economical, and reliable. (auth)

Radioactive Waste Treatment

Refer also to abstracts 12246, 13465, and 13572.

11255 (TID-3311-S6) RADIOACTIVE WASTE PROCESSING AND DISPOSAL. (Energy Research and Development Administration, Oak Ridge, Tenn. (USA). Technical Information Center). Jul 1975. 283p. Dep. NTIS $7.60.

Reference to 2140 publications related to radioactive waste, announced in Nuclear Science Abstracts (NSA) Volumes 28 (July-Dec. 1973), 29 (Jan.-June 1974), and 30 (July-Dec. 1974), are presented. The references are arranged by the original NSA abstract number, which approximately places them in chronological order. Sequence numbers appear beside each reference and the NSA volume and abstract numbers appear at the end of the citations. Three indexes are provided: Personal Author, Subject, and Report Number. This document supplements the preceding six in the TID-3311 series. (auth)

11256 LEACHING OF RADIOACTIVE MATERIALS AT THE SALT LAKE CITY URANIUM MILL TAILINGS SITE. Rogers, V. C. (IRT Corp., San Diego, CA); Sandquist, G. M.; Byrne, J. Trans. Am. Nucl. Soc.; 21: 94(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11257 ELIMINATION OF ACTINIDES WITH LMFBR RECYCLE. Breen, R. J. (Westinghouse Electric Corp., Madison, PA). Trans. Am. Nucl. Soc.; 21: 262(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11258 BIDENTATE ORGANOPHOSPHORUS SOLVENTS: EXTRACTION OF Am-Pu FROM HANFORD'S PRF WASTE STEAM. Schulz, W. W. (Atlantic Richfield Hanford Co., Richland, WA). Trans. Am. Nucl. Soc.; 21: 262-263(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11259 IN-PLANT RADWASTE SYSTEMS APPROACH NEAR-ZERO DISCHARGE. Elec. Light Power (Boston); 53: No. 4, E/G4-E/G5(21 Apr 1975).

The disposal methods for low-level waste from nuclear power plants and the treatment and handling hardware required are discussed. The liquid solidification system continuously mixes radwaste and cement and feeds the resulting paste into a container. The container is sealed and decontaminated, all automatically. A process using sodium silicate as an additive to Portland cement for liquid radwaste solidification was developed that is cheaper than either urea formaldehyde systems or use of Portland cement without additives. It offers higher shipping efficiency than pure cement and is better able to solidify troublesome sulfate wastes than urea formaldehyde. A new liquid radwaste solidification method using a fluid-bed dryer achieves much better volume reduction than conventional methods. This method, developed by Aerojet Energy Conversion Co. and called VR-20, converts liquid wastes to anhydrous solids in the dryer. A separate dryer is used for wet solids. The dried wastes are encapsulated as a water-free, monolithic, homogeneous solid. In the Werner & Pfleiderer Process, heated distilled bitumen is mixed with liquid and solid wastes in a screw mixer. The mixture passes through steam domes where 99.5% or more of the water is evaporated from the mixtures, setting up in standard drums. Sandia Laboratories has developed a liquid waste treatment involving ion exchange. Liquid radwaste passes through a column of ion exchange resins; the radioactive ions are pulled from the liquid and retained in the column. The solid material in the column is heated and converted to a stable insoluble, ceramic material. (MCW)

Radioisotope Production

11260 REACTOR LOOP FOR CONTINUOUS PRODUCTION OF GASEOUS FISSION PRODUCT RADIOISOTOPES. I. ^{235}U-Loaded Molecular Sieve Target. McLain, M. E. Jr. (Georgia Inst. of Tech., Atlanta). Int. J. Appl. Radiat. Isotop.; 26: No. 3, 107-118(Mar 1975).

The development of high surface area fissile targets by the deposition of ^{235}U on molecular sieves and silica gel provides a matrix from which the gaseous fission products readily diffuse. Collection of the fission product gases by helium sweep gas circulated through such a target installed in a reactor neutron flux constitutes a loop system for the continuous production of fission product gases, e.g. ^{135}Xe. This system has provided ^{135}Xe for medical diagnostic clinical evaluations and mixed fission product gases for study of reactor stack monitor systems performance. (auth)

11261 PROPOSED MECHANISM OF RETENTION OF TIN DIOXIDE WITH RESPECT TO THE Cu^{2+} ION. Jaffrezic-Renault, N.; Deschamps, N. (CEN de Saclay, Gif-sur-Yvette, France). Radiochem. Radioanal. Lett.; 21: No. 6, 343-348(16 Jun 1975). (In French).

A determination was made of acidity of commercial tin dioxide by titration with aqueous sodium hydroxide. Its capacity for Cu^{2+} (1.5×10^{-5} ion-gram per gram SnO_2) is found to be nearly equal to its acidity (0.8×10^{-5}–1.2×10^{-5} iron-gram H^+ per gram SnO_2). From these results a mechanism is proposed. (LK)

Reactor Fuel Reprocessing

Refer also to abstracts 12253, 13625, 13676, and 13696.

11262 (DOCKET 50332-49) BARNWELL NUCLEAR FUEL PLANT. License Application, Amendment 10. (Allied-Gulf Nuclear Services, Barnwell, S. C. (USA)). 30 Apr 1975. 940p. Dep. NTIS $50.00.

Amendment No. 10 provides the applicant's responses to questions raised by the AEC in letters dated November 6 and December 5, 1974, Amendment No. 3, dated February 1975, to the BNFP Separations Facility Final Safety Analysis Report (FSAR) is included. The amendment consists of revision pages for volumes 1 through 5 of the FSAR along with a deletion and insertion guide. (LK)

11263 (GERHTR-106) 1973 PROGRESS REPORT OF THE INSTITUTE FOR CHEMICAL TECHNOLOGY. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany)). 1973. 14p. (In German). Dep. NTIS (US Sales Only) $4.00.

Work performed under United States–German High Temperature Reactor Research Exchange Program.

Work done on the planning of the JUPITER semi-industrial installation for the reprocessing of HTR fuel elements, laboratory studies on development of refabrication methods, and development of processes for the processing and disposal of radioactive wastes is briefly summarized. A list of publications and reports is appended. (JSR)

11264 STATUS REPORT: LICENSING OF NUCLEAR FUEL CYCLE PLANTS. Larson, H. J.; Cunningham, R. E. (Nuclear Regulatory Commission, Washington, DC). Trans. Am. Nucl. Soc.; 21: 239(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11265 REACTION OF IODINE WITH CONCENTRATED NITRIC ACID. Mailen, J. C.; Tiffany, T. O. (Oak Ridge National Lab., TN). Trans. Am. Nucl. Soc.; 21: 251(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11266 PROMOTION OF PuO_2 DISSOLUTION IN NITRIC ACID WITH CERIUM. Horner, D. E.; Crouse, D. J.; Kappelmann, F. A.; Goode, J. H. (Oak Ridge National Lab., TN). Trans. Am. Nucl. Soc.; 21: 252(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11267 EFFECT OF OXIDATION STATE OF DISSOLVED PLUTONIUM ON PuO_2 DISSOLUTION. Tallent, O. K.; Mailen, J. C. (Oak Ridge National Lab., TN). Trans. Am. Nucl. Soc.; 21: 252-253(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11268 FATE OF ALIPHATIC COMPOUNDS IN NITRIC ACID PROCESSING SOLUTIONS. Clark, W. E.; Howerton, W. B. (Oak Ridge National Lab., TN). Trans. Am. Nucl. Soc.; 21: 253-254(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11269 GENERIC FUEL REPROCESSING PLANT SAFETY ANALYSIS. Cooperstein, R.; Erdmann, R. C.; Fullwood, R. (Science Applications, Inc., La Jolla, CA). Trans. Am. Nucl. Soc.; 21: 254-255(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

CONTROLLED THERMONUCLEAR RESEARCH

11270 AEC AUTHORIZING LEGISLATION, FISCAL YEAR 1975. Part 4. Hearings Before the Joint Committee on Atomic Energy, Congress of the United States, Ninety-Third Congress, Second Session on Controlled Thermonuclear Research; Biomedical and Environmental Research; Waste Management; Operational Safety; and Nuclear Materials, March 4 and 5, 1974. Washington, DC; Joint Committee on Atomic Energy (1975). 411p. GPO.

Testimony before the JCAE in support of funding requests for the fiscal year 1975 in the fields of thermonuclear research, biomedical and environmental research, waste management, and operational safety is presented. (TFD)

Plasma Confinement and Heating

Refer also to abstract 11393.

11271 (CONF-750224-, pp 1.1-1.6) ION CYCLOTRON RESONANCE IN A TOROIDAL MAGNETIC FIELD. Gould, R. W. (California Inst. of Tech., Pasadena). Mar 1975.

From proceedings of the U. S.-Australian workshop on plasma waves; Sydney, Canberra, and Adelaide, Australia (13 Feb 1975).

In proceedings of the U. S.–Australian workshop on plasma waves. (Sydney Univ. (Australia)).

It is shown that a plasma in a static toroidal magnetic field, whose magnitude varies as $1/r$, forms a toroidal resonator which exhibits both a discrete and continuous spectrum of resonant frequencies. The latter results from the spatially inhomogeneous toroidal field. Associated with each mode of the continuum is a resonant absorption layer (r = constant) but the location of the layer does not correspond to the point where the cyclotron resonance condition is fulfilled locally. Inclusion of finite Larmor radius effects causes the resonant absorption to be replaced by mode conversion. The excitation of the modes for the purpose of plasma heating and their connection with Alfvén and magnetosonic waves in a homogeneous plasma is discussed. (auth)

11272 (CONF-750224-, pp 4.1-4.5) LOW FREQUENCY MHD WAVE HEATING OF PLASMAS IN LINEAR AND TOROIDAL GEOMETRY. Shohet, J. L. (Univ. of Wisconsin, Madison). Mar 1975.

From proceedings of the U. S.-Australian workshop on plasma waves; Sydney, Canberra, and Adelaide, Australia (13 Feb 1975).

In proceedings of the U. S.–Australian workshop on plasma waves. (Sydney Univ. (Australia)).

Several methods have been utilized or proposed for heating of plasmas confined by magnetic fields. One form of this is transit-time magnetic pumping which was utilized on stellarator experiments but resulted in loss of containment. A possible explanation for this pumpout is the conversion of trapped to circulating particles outside the separatrix of the closed surfaces surrounding the magnetic axis, due to the fact that the TTMP driving frequency and the trapped particle bounce frequency are of the same order of magnitude. A slow wave structure, required to trap the ions in TTMP, can also be used to trap the electrons and produce a net circulating current in a toroidal system, and also to excite low frequency MHD modes in the system. Measurement of the input impedance of the slow wave structure as a function of frequency may be made to verify the excitation of MHD modes. (auth)

11273 (CONF-750224-, pp 5.1-5.6) ION HEATING IN TOKAMAKS BY WAVE PENETRATION AND PARAMETRIC DOWNCONVERSION OF RF POWER. Bers, A. (Massachusetts Inst. of Tech., Cambridge). Mar 1975.

From proceedings of the U. S.-Australian workshop on plasma waves; Sydney, Canberra, and Adelaide, Australia (13 Feb 1975).

In proceedings of the U. S.–Australian workshop on plasma waves. (Sydney Univ. (Australia)).

The possibilities of using high-power microwaves for exciting fields in the central part of a tokamak-type plasma are discussed. Conditions are established under which these fields either Landau damp on the electrons or excite large amplitude ion oscillations by parametric downconversion to electrostatic ion cyclotron waves. (auth)

11274 (CONF-750224-, pp 7.1-7.3) SOME DC EFFECTS IN AN RF DISCHARGE. Lehane, J. A.; Schmidt-Harms, C. A. (Univ. of Sydney). Mar 1975.

From proceedings of the U. S.-Australian workshop on plasma waves; Sydney, Canberra, and Adelaide, Australia (13 Feb 1975).

In proceedings of the U. S.–Australian workshop on plasma waves. (Sydney Univ. (Australia)).

In experiments on ion cyclotron resonance heating (ICRH) the RF energy is coupled into the plasma via torsional Alfvén waves. In this type of experiment Stix coils are almost universally used [Stix (1958), Hooke et al (1961)]. Furth (1959) proposed using concentric electrodes to excite the torsional mode. This method was employed by Boley et al (1963). In an experiment designed to extend the work of these authors, considerable fluctuations in the amplitude of the detected wave signal were observed. The measurements presented here represent an attempt to understand these fluctuations. (auth)

11275 (CONF-750224-, pp 8.1-8.4) SOME FURTHER STUDIES OF RADIOFREQUENCY SUPPLEMENTED MIRROR CONFINEMENT. Gray, E. P. (Johns Hopkins Univ., Baltimore). Mar 1975.

From proceedings of the U.S.-Australian workshop on plasma waves; Sydney, Canberra, and Adelaide, Australia (13 Feb 1975).

In proceedings of the U.S.-Australian workshop on plasma waves. (Sydney Univ. (Australia)).

It has been suggested by Watson and Kuo-Petravic, and numerically verified by Gray, that the loss cone of a magnetic mirror can be reduced or even closed, without heating the confined plasma, by the application of an rf field at a frequency slightly above the maximum cyclotron frequency encountered by an ion within the mirror. Klima and Lichtenberg have pointed out some difficulties with this scheme. The improved confinement requires a frequency quite close to cyclotron resonance, but the adiabatic invariance on which the scheme is based breaks down in this regime. (auth)

11276 (CONF-750224-, pp 28.1-28.4) STRONG SHOCK WAVE HEATING TO FUSION TEMPERATURES IN STRONG MAGNETIC FIELDS. Taussig, R. T. (Columbia Univ., New York, NY). Mar 1975.

From proceedings of the U.S.-Australian workshop on plasma waves; Sydney, Canberra, and Adelaide, Australia (13 Feb 1975).

In proceedings of the U.S.–Australian workshop on plasma waves. (Sydney Univ. (Australia)).

A two-temperature, one-dimensional magnetohydrodynamic model of a collision-dominated plasma with anisotropic transport properties is used to determine the shock structure and MHD piston dynamics for shock wave heating in hydrogen. Ions are heated preferentially in such shocks and in the special case of antiparallel magnetic fields intense ion heating is also found in the MHD piston region. Computations for coaxial electromagnetic shock tube conditions and for the initial stages of belt pinch heating are compared to recent experimental observations. The possible application of this model to solid density plasmas is also discussed. (auth)

11277 (CONF-750224-, pp 29.1-29.3) IMPLOSION AND STAGING IN THETA PINCHES. Thomassen, K. I. (Los Alamos Scientific Lab., NM). Mar 1975.

From proceedings of the U.S.-Australian workshop on plasma waves; Sydney, Canberra, and Adelaide, Australia (13 Feb 1975).

In proceedings of the U.S.–Australian workshop on plasma waves. (Sydney Univ. (Australia)).

The physics and technology of implosion and staging in theta-pinch fusion devices is becoming increasingly important, as can be seen by the designs of the next generation of such devices. The implosion by ultra-fast high voltage circuits, and staging or holding the magnetic field until the slower compression field rises, is necessary to create high temperature, large radius plasmas. The subsequent adiabatic compression must bring the plasma to ignition without compressing the plasma to so small a radius that wall stabilization of the dominant $m = 1$ mode (of the toroidal plasma with imposed helical equilibrium fields) is lost. The theoretical, experimental, and machine design studies at Los Alamos on implosion and staging are described. (auth)

11278 (CONF-750224-, pp 30.1-30.4) MULTIPLE SHOCK WAVE COMPRESSION OF GASES. Phillips, M. G. R. (Flinders Univ. of South Australia, Bedford Park). Mar 1975.

From proceedings of the U.S.-Australian workshop on plasma waves; Sydney, Canberra, and Adelaide, Australia (13 Feb 1975).

In proceedings of the U.S.–Australian workshop on plasma waves. (Sydney Univ. (Australia)).

In the proposed laser fusion scheme, a series of converging shock waves is used to compress matter to extremely high densities. In principle, very high compression of a gas could also be achieved in a shock tube where the consecutive shock waves are generated electrothermally by capacitor discharges. Preliminary theoretical and experimental studies of this phenomenon are reported. (auth)

11279 (UCRL-76438) FUSION PLASMA LOSSES DUE TO THE CHARGE EXCHANGE OF INJECTED NEUTRALS. Bender, D. J.; Carlson, G. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Apr 1975. 37p. (CONF-750607-19). Dep. NTIS $5.00.

From American Nuclear Society meeting; New Orleans, Louisiana, USA (8 Jun 1975).

The interaction of a neutral beam, consisting of full, half and third energy components, with a mirror plasma is analyzed. The beam-plasma interaction is assumed to occur via ionization and charge exchange collisions. The plasma was approximated as being spherical in shape, having a uniform density, isotropic velocity distribution, and a mirror plasma energy distribution. It was found that to a first approximation, for plasma energies less than 100 keV, the charge exchange power loss (per injected atom) of the half energy component is at least twice that of the full energy component. For the third energy component, the loss is at least three times that of the full energy component. For some plasma conditions, the neutral beam can act as an energy sink for the plasma due to these charge exchange losses. (auth)

11280 INJECTION TECHNOLOGY FOR THE TOKAMAK FUSION TEST REACTOR. Morgan, O. B. (Oak Ridge National Lab., TN); Pyle, R. V. Trans. Am. Nucl. Soc.; 21: 13-14(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11281 ENERGY SPECTRUM OF INJECTED FUSSILE IONS IN TWO-COMPONENT FUSION SYSTEMS. Husseiny, A. A. (Carnegie-Mellon Univ., Pittsburgh); Sabri, Z. A.; Harris, D. A. Trans. Am. Nucl. Soc.; 21: 42-43(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11282 EFFECT OF RADIATION LOSSES ON FUSION ENERGY BALANCES. Miley, G. H.; Chu, T. C. (Univ. of Illinois, Urbana). Trans. Am. Nucl. Soc.; 21: 43-44(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11283 FUSION PLASMA LOSSES DUE TO THE CHARGE EXCHANGE OF INJECTED NEUTRALS. Bender, D. J.; Carlson, G. A. (Univ. California, Livermore). Trans. Am. Nucl. Soc.; 21: 44-45(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

Plasma Diagnostics

11284 (CONF-750224-, pp 12.1-12.4) SCATTERING OF MICROWAVES FROM A PLASMA COLUMN. Blevin, H. A.; Liddle, P. F.; How, J. A. (Flinders Univ. of South Australia, Bedford Park). Mar 1975.

From proceedings of the U.S.-Australian workshop on plasma waves; Sydney, Canberra, and Adelaide, Australia (13 Feb 1975).

In proceedings of the U.S.-Australian workshop on plasma waves. (Sydney Univ. (Australia)).

The coherent scattering of waves is employed in many branches of physics to determine the spatial distribution of a property of the scattering medium. This work describes the application of this technique to the measurement of the electron density distribution in a laboratory plasma column. Because it is the detailed structure of the free space wave fields which carries the required information, the presence of equipment associated with the production and refinement of the plasma greatly complicates the situation. The transmitting and receiving antenna must be reasonably close to the plasma and the conventional treatment of scattering processes, in which the source and receiver are assumed to be effectively at infinity, is inadequate. (auth)

11285 (CONF-750224-, pp 25.1-25.4) PLASMA ROTATION MEASUREMENTS USING ION ELECTROSTATIC WAVES. Brand, G. F. (Univ. of Sydney). Mar 1975.

From proceedings of the U.S.-Australian workshop on plasma waves; Sydney, Canberra, and Adelaide, Australia (13 Feb 1975).

In proceedings of the U.S.-Australian workshop on plasma waves. (Sydney Univ. (Australia)).

A dispersion equation is derived for electrostatic waves only. The condition for ion electrostatic waves is shown. These conditions are described for the SUPPER machines. (MOW)

Plasma Kinetics (General)

11286 STUDY BY ELECTRONIC PARAMAGNETIC RESONANCE OF THE THREE-BODY RECOMBINATION IN A NITROGEN AFTERGLOW. Bediee, S.; Tchen, H. (Rennes- 1 Univ., 35 (France)). Compt. Rend., Ser. A, B; 280: No. 8, 219-221(24 Feb 1975). (In French).

The three-body recombination coefficient in a nitrogen afterglow at pressures from 2.2 to 3.2 torr is determined using theoretical and experimental methods. The atomic concentrations are measured by the EPR method. (FR)

11287 TRANSITION LEADER CORONA-LEADER FOR LONG AIR GAPS. Goldman, M.; Berger, G. (Ecole Superieure d'Electricite, 92- Malakoff (France)). Compt. Rend., Ser. A, B; 280: No. 7, 167-169(17 Feb 1975). (In French).

The leader corona-leader transition is explained by a new ionization process: the ionic heating of the leader corona channel leads to the electron detachment from negative ions since a temperature over 1,000 deg K can be derived from the leadertip. (FR)

11288 COMPRESSION OF A PLASMA COLUMN OF INFINITE ELECTROCONDUCTIVITY SITUATED IN AN EXTERNAL AXIAL MAGNETIC FIELD. Zoler, D.; Grosu, I.; Laur, F.; Gazi, R.; Ruscanu, D. (Physical and Technical Research Centre, Iassy (Romania)). J. Phys. (Paris).; 36: No. 1, 45-58(Jan 1975).

The effect of an external axial magnetic field of a selfcompressed plasma was studied. Firstly, a set of equations describing the actual situation is derived by means of a generalized model. Secondly, the results of a numerical calculation using a double spacestep and varying timestep in the Lax-Wendroff scheme are analyzed. The effect of the external magnetic field on plasma parameters such as: plasma velocity, ion temperature, electron temperature and plasma density is analyzed. The experimental results are compared with theory and are found to be in good agreement especially for the later times of the compression stage. At one stage, the plasma column radius is greater than the corresponding one for the case with no magnetic field. All the calculations are performed for a deuterium gas compression. (FR)

11289 RADIATIVE COOLING OF AN ARGON PLASMA PRODUCED IN A CLASSICAL SHOCK TUBE. Pinegre, M.; Valentin, P. (Rouen Univ., 76- Mont-Saint-Aignan (France). Lab. de Thermodynamique). Compt. Rend., Ser. A, B; 279: No. 23, 551-554(2 Dec 1974). (In French).

The effect of radiative energy losses due to the continuum background and the line spectrum on the thermodynamic parameters of an argon plasma is calculated and compared with experimental values for a shock wave velocity varying from 5 to 10 km/sec. (auth)

11290 POPULATION INVERSION IN LASER-PRODUCED PLASMAS BY PUMPING WITH OPACITY-BROADENED LINES. Norton, B. A.; Peacock, N. J. (UKAEA, Abingdon, Eng.). J. Phys., B. (London); 8: No. 6, 989-996(21 Apr 1975).

It has been noted that line radiation—for example, the first member of the Lyman series of C^{5+}—is optically thick at the surface of a laser-irradiated carbon target. Optical depths of the order of 10^4 can be anticipated with appropriate focusing geometry. Using such an optically thick and broadened line source it is calculated that population inversion and a measurable superradiant gain can be achieved by resonance pumping in neighbouring ion species. (auth)

11291 ON THE EMISSION OF BLACK-BODY RADIATION FROM DENSE PLASMAS. Hora, H.; Lochte-Holtgreven, W. (Kiel Univ. (F. R. Germany). Inst. fuer Experimentalphysik). Atomkernenergie; 25: No. 1, 53-54(1975). (In German).

2 figs.; 5 refs.

Plasma emits black-body radiation if the electron density determines a plasma frequency equal to or higher than the frequency of Wien's maximum. The radiation losses are discussed for discharges, exploding wires, and for laser produced plasmas. (auth)

11292 RADIOPROTECTION AROUND PLASMA-FOCUS MACHINES. Bardina, R.; Merolli, S.; Pelliccioni, M.; Samuelli, M. (CNEN: Frascati, Italy). Health Phys.; 28: No. 5, 612-615 (May 1975).

Problems arising from the radiation levels, caused by neutrons, x-rays above 10 keV, and γ-rays above 100 keV, around plasma focus machines are discussed. Shielding requirements and factors affecting the choice of neutron dosimeters are considered. (UK)

Plasma Kinetics (Experimental)

11293 (CONF-750224-, pp 35.1-35.4) COMPENSATED DIAMAGNETIC LOOPS NEAR A CONDUCTING WALL IN UNIFORM

AND NONUNIFORM MAGNETIC FIELDS. Swanson, D. G. (Univ. of Southern California, Los Angeles). Mar 1975.

From proceedings of the U.S.-Australian workshop on plasma waves; Sydney, Canberra, and Adelaide, Australia (13 Feb 1975).

In proceedings of the U.S.-Australian workshop on plasma waves. (Sydney Univ. (Australia)).

The measurement of plasma diamagnetism by a simple diamagnetic loop can be significantly altered by the presence of a conducting wall and its associated eddy currents. These effects can be significantly reduced by the use of compensated diamagnetic loops. It is shown that the wall effects are of order β compared to the diamagnetic term in a uniform magnetic field. With field inhomogeneities, however, the error terms may be larger than the diamagnetic term for compensated loops. Field distortion limits are discussed in relation to plasma induced distortions and vacuum field distortions due to a slowly varying magnetic field. (auth)

11294 RECOMBINATION IN COLD HIGH PRESSURE HELIUM. Stangeby, P. C.; Wong, W. T. (Toronto Univ., Ontario (Canada). Inst. for Aerospace Studies). Phys. Lett., A; 51: No. 5, 312-314 (24 Mar 1975).

In order to establish the plasma-physics behavior of the gas target plasma, the existing low pressure recombination models have been examined to ascertain their relevance to the higher pressures. A widely held view is that in fact the $p > 100$ torr recombination regime for cold He is highly complex and that models established for $p < 100$ torr are not readily extendable to higher pressures. It was the finding of the present work, that on the basis of the existing experimental results for $p > 100$ torr it is not evident that new recombination mechanisms need to be postulated beyond those established for $p < 100$ torr. What is required, is the inclusion of recycle mechanisms, which have recently been identified as critical even for $p < 100$ torr. Calculations were carried out employing all the established recombination processes. (auth)

11295 ELECTRONS AND EXCITED ATOMS AHEAD OF A SHOCK WAVE IN ARGON. Pinegre, M.; Valentin, P. (CEA Centre d'Etudes de Vaujours, 93- Sevran (France); Rouen Univ., 76- Mont-Saint-Aignan (France). Lab. de Thermodynamique). Compt. Rend., Ser. A, B; 280: No. 8, 215-218(24 Feb 1975). (In French).

Experimental investigations of precursors ahead of pressure driven shock waves in argon show that electron density number and excited atoms density numbers are 10^{18} and $10^{13} m^{-3}$ respectively when shock wave velocity is 7,500 m/s. (FR)

11296 CALCULATION OF BALMER LINE PROFILES. Stamm, R.; Voslamber, D. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Groupe de Recherches sur la Fusion Controlee; CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. De Physique du Plasma et de la Fusion Controlee). Compt. Rend., Ser. A, B; 280: No. 8, 223-226(24 Feb 1975). (In French).

A simple approximation for the collision operator occurring in the unified theory of plasma line broadening is introduced. This approximation permits one to calculate easily and with reasonable accuracy the higher members of the Balmer series. (FR)

Plasma Kinetics (Theoretical)

11297 (CONF-750224-, pp 16.1-16.4) QUASI-LINEAR RELAXATION OF A SUPRA-THERMAL BEAM OF ELECTRONS IN A COLLISIONLESS PLASMA. Grognard, R. J. M. (CSIRO, Sydney). Mar 1975.

From proceedings of the U.S.-Australian workshop on plasma waves; Sydney, Canberra, and Adelaide, Australia (13 Feb 1975).

In proceedings of the U.S.-Australian workshop on plasma waves. (Sydney Univ. (Australia)).

An asymptotic study of the quasi-linear equations is briefly discussed. A numerical solution is given for the one-dimensional and homogeneous case. (MOW)

11298 (CONF-750224-, pp 17.1-17.3) ANOTHER POSSIBILITY OF NUMERICAL CALCULATION OF A SOLUTION TO THE ONE-DIMENSIONAL NON-LINEAR TIME-DEPENDENT VLASOV-MAXWELL EQUATIONS. Duniec, J. (Australian National Univ., Canberra). Mar 1975.

From proceedings of the U.S.-Australian workshop on plasma waves; Sydney, Canberra, and Adelaide, Australia (13 Feb 1975).

In proceedings of the U.S.-Australian workshop on plasma waves. (Sydney Univ. (Australia)).

The one-dimensional relativistic system of Vlasov-Maxwell equations is solved. The method of proof is based on the contraction mapping theorem applied to a nonlinear integral equation which can be derived using initial conditions. (MOW)

11299 (CONF-750224-, pp 34.1-34.6) CROSS-POWER MEASUREMENTS OF PLASMA TURBULENCE. Harker, K. J.; Ilic, D. B.; Crawford, F. W. (Stanford Univ., CA). Mar 1975.

From proceedings of the U.S.-Australian workshop on plasma waves; Sydney, Canberra, and Adelaide, Australia (13 Feb 1975).

In proceedings of the U.S.-Australian workshop on plasma waves. (Sydney Univ. (Australia)).

An analog cross-power spectrum analyzer operating up to 30 MHz was constructed and applied to the study of ion-acoustic wave turbulence in a positive column. In principle, the complete $(\omega,\underset{\sim}{k})$ spectrum can be determined by recording the cross-power spectrum of the signals from two probes in the plasma, and deriving the spatial transform of this spectrum as a function of the probe separation. The first step in this process has been taken by determining the dispersion characteristics of ion acoustic waves assuming a one-dimensional, weakly-excited spectrum. (auth)

11300 EQUILIBRIUM SHAPE: A NONLINEAR EIGENVALUE PROBLEM. Temam, R. (Paris- 11 Univ., 91- Orsay (France)). Compt. Rend., Ser. A, B; 280: No. 7, 419-421(17 Feb 1975). (In French).

The equilibrium shape of a confined plasma is determined by the solution of a new type of free boundary value problem. This problem is equivalent to a nonlinear eigenvalue problem; the existence of solutions of this nonlinear eigenvalue problem is proved, and these solutions are critical points of appropriate functionals. (FR)

11301 DIFFUSION IN A TWO-DIMENSIONAL PLASMA OF GUIDING CENTERS. LeQueau, D.; Laval, G.; Pellat, R. (Ecole Polytechnique, 75- Paris (France). Centre de Physique Theorique). Compt. Rend., Ser. A, B; 279: No. 11, 291-293(9 Sep 1974). (In French).

The transverse diffusion coefficient is calculated for a guide-center plasma idealized by a population of current rods parallel to the main strong magnetic field B. This current rod population moves perpendicularly to B_0. The problem is two-dimensional. Diffusion is caused by fluctuations of the magnetic field which arise at thermodynamic equilibrium in the interactions of the current rods with one another. These fluctuations are assumed to develop at k(parallel) = 0. Periodic boundary conditions are imposed in the longitudinal dimension, which gives a direction and isolates without difficulty the mode k(parallel) = 0 equivalent to the mode of wavelength L(parallel) in the toroidal geometry chosen. (FR)

11302 EPR: PLASMA DYNAMIC STUDIES WITH ZERO-DIMENSIONAL TIME-DEPENDENT TRANSPORT CODE. Harder, C. R.; Petersen, P. I. (General Atomic Co., San Diego, CA). Trans. Am. Nucl. Soc.; 21: 43(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11303 FINITE ELEMENT PLASMA DIFFUSION CODE FOR ARBITRARY TOROIDAL GEOMETRY. Hennart, J. P. (Instituto Poitecnico Nacional, Mexico City); Martin, J. G.; Gutierrez, J. S. Trans. Am. Nucl. Soc.; 21: 225-226(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11304 POPULATION DENSITIES AND IONIZATION COEFFICIENTS OF FAST TRANSIENT HYDROGEN PLASMAS. Cacciatore, M.; Capitelli, M. (Bari Univ. (Italy). Dipartimento di Chimica). Z. Naturforsch., A; 30: No. 1, 48-54(Jan 1975).

From 2nd European study conference on atomic and molecular physics of ionized gases; Innsbruck, Austria (3 Sep 1974). 6 figs.; 5 tabs.; 7 refs.

Population densities and ionization coefficients of transient hydrogen plasmas have been calculated for typical ionization and recombination conditions. The results have been obtained by solving a system of differential equations by means of the Runge-Kutta method. Each equation describes the temporal evolution of a quantum state belonging to the plasma. Two initial conditions have been studied: (i) The number density populations of the excited states are in Saha equilibrium with the electrons, (ii) the densities of excited states are equal to zero, whereas the initial condition for the ground state density is characterized by a non-equilibrium parameter $b_1(t = 0) = n_1/n_{1E}$, which has been varied from 10^6 to 10^{-2}. Typical result for electron number densities n_e ranging from 10^8 to 2.5×10^{13} p/cm^3 and electron temperatures ranging from T = 8,000 to 16,000 K are presented and discussed. (auth)

11305 EFFECTS OF EXTERNAL FIELDS ON THE POTENTIAL OF A TEST CHARGE IN A PLASMA. Tegeback, R.;

Stenflo, L. (Umeaa Univ. (Sweden). Plasmafysiska Institutionen). Z. Phys., B.; 20: No. 1, 105-108(1975).
10 refs.
This paper considers the far field potential of a stationary test charge in a plasma. It is shown that external fields can have a significant influence on the potential which can be very large when an upper hybrid wave propagates through the plasma. (auth)

Plasma Production

11306 (UCID-16770) PARAMETER STUDY OF THE BEHAVIOR OF LINEARLY EXPANDING LASER PLASMAS. Jensen, R. B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 16 Apr 1975. Contract W-7405-eng-48. 61p. Dep. NTIS $6.25.
An approximate analytic description of the expansion of disk shaped laser targets is given in terms of these parameters. Estimates are derived from computer simulations and hydrodynamic theory for the prediction of time scales, peak densities, scale heights and temperatures for the laser plasmas. The most useful results are summarized in the conclusion. Furthermore, a list of crude thresholds for the most important known plasma instabilities is compiled which may be utilized in conjunction with the expressions for the characteristic parameters to design preliminary experiments for the investigation of plasma phenomena. (MOW)

11307 INTERFEROMETRIC OBSERVATIONS OF A COLD PLASMA-CORE IN LASER-PRODUCED PARTICLE PLASMAS. Samson, J. C.; Alcock, A. J. (National Research Council of Canada, Ottawa, Ontario. Div. of Physics). Phys. Lett., A; 51: No. 5, 315-316(24 Mar 1975).
Nanosecond-interferometry indicates that the plasmas formed by the Q-switched laser-irradiation of single LiH particles have a cold, and possibly turbulent, core of dense plasma. (auth)

11308 EXPERIMENTAL DETERMINATION OF THE POSITION AND SIZE OF THE CUT-OFF DENSITY REGION IN A DEUTERIUM LASER PRODUCED PLASMA. Saleres, A.; Decroisette, M. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)). Phys. Lett., A; 51: No. 6, 379-380(7 Apr 1975).
Harmonic and subharmonic occurrence during interaction of a high power Nd glass laser beam with a solid deuterium target was previously reported; $\frac{3}{2}\omega_0$ and $2\omega_0$ lines were recorded either 45° apart from the beam axis or in the backscattered direction. Analysis of the backscattered radiation makes possible the determination of the radiation flux value inside the plasma. (auth)

11309 NUCLEAR REACTOR FUEL FOR A NUCLEAR FUSION PROCESS. (to KMS Fusion Inc.). Netherlands Patent 7,211,397/A/. 21 Aug 1972. 21p. (In Dutch).
The invention provides a controlled release of fusion energy using a laser. The obtained energy from the laser is centered on a small amount of fusion fuel. Indications for the technical execution and an extensive description of the computer calculations analyzing the process are given. (NL)

Plasma Stability

Refer also to abstract 11399.

11310 (CONF-750224-, pp 20.1-20.6) THREE-DIMENSIONAL PULSE SHAPES OF LASER-PLASMA INSTABILITIES. Bers, A. (Massachusetts Inst. of Tech., Cambridge). Mar 1975.
From proceedings of the U.S.-Australian workshop on plasma waves; Sydney, Canberra, and Adelaide, Australia (13 Feb 1975).
In proceedings of the U.S.-Australian workshop on plasma waves. (Sydney Univ. (Australia)).
The theory for pinch-point time asymptotic three-dimensional pulse-shape analysis discussed in the previous paper will be applied to five different nonlinear instabilities with parameters appropriate to the laser-pellet interaction problem. (auth)

11311 (CONF-750224-, pp 26.1-26.7) EVOLUTION OF CURRENT-DRIVEN INSTABILITIES AND ANOMALOUS PROPERTIES IN ISOTHERMAL INHOMOGENEOUS PLASMAS. Hendel, H. W.; Yamada, M. (Princeton Univ., NJ). Mar 1975.
From proceedings of the U.S.-Australian workshop on plasma waves; Sydney, Canberra, and Adelaide, Australia (13 Feb 1975).
In proceedings of the U.S.-Australian workshop on plasma waves. (Sydney Univ. (Australia)).
Successive destabilization of four different instabilities with increasing current ($u/v_{the} = 0$-$\frac{1}{3}$) is observed in isothermal plasmas, together with anomalous plasma properties caused by instability-particle interactions. Instabilities and their effects are largely determined by the radial inhomogeneities of the plasma, in agreement with predictions. (auth)

11312 (MPI-PAE/EXTRATERR-106) DRIFT WAVE INSTABILITIES IN PLASMAS WITH SHEAR FLOW. Haerendel, G. (Max-Planck-Institut fuer Physik und Astrophysik, Garching/Muenchen (F. R. Germany). Inst. fuer Extraterrestrische Physik). Nov 1974. 31p. INIS.
3 figs.; 8 refs. Published in J. Plasma Phys.
The average drift of ions in a non-uniform electric field transverse to a homogeneous magnetic field differs slightly from that of the electrons becuase of their larger gyroradius. In the presence of a plasma density gradient an electric current results which we name drift shear current. This current can act in a destabilizing manner on the equilibrium plasma distribution. (auth)

11313 (ORO-2598-9) INSTABILITIES DUE TO ANISOTROPIC VELOCITY DISTRIBUTIONS. Progress report, June 1, 1974-June 1, 1975. Harris, E. G. (Tennessee Univ., Knoxville (USA). Dept. of Physics). 1975. Contract AT(40-1)-2598. 15p. Dep. NTIS $4.00.
A continuing theoretical study of plasma instabilities and related phenomena including nonlinear effects, particle and energy transport and heating schemes is presented. In the past year, a study of linear resistive instabilities with applications to Tokamaks was almost completed and is being prepared for publication. A sigma stability analysis is being worked on at the present time. Some thought was given to a nonlinear resistive instability analysis but not much progress has been made. A study of equilibrium and stability of elliptical cross section Tokamaks was completed. Considerable work was completed on plasma heating by rf waves at the lower hybrid frequency and by Alfven waves. This work is continuing. A study of instabilities excited by runaway beams of electrons in Tokamaks was largely completed. Some work was done on trapped particle instabilities in Tokamaks and their relation to other instabilities driven by gradients of density or temperature. Work is underway on diffusion and thermal conduction in the bumpy torus. (auth)

11314 PLASMA STABILIZATION. Kukhterko, A.; Samojlenko, Yu. Veda Tech. SSSR.; 2: No. 4, 42-50(Aug 1974). (In Czech).
A brief account of the methods of plasma stabilization is given. (INIS)

11315 IMPROVEMENTS IN OR RELATING TO STABILIZING PLASMA CONFINEMENT SYSTEMS. Bickerton, R. J.; Taylor, J. B.; Connor, J. W. (to United Kingdom Atomic Energy Authority). British Patent 1,382,412/B/. 29 Jan 1975. Filed date 4 Nov 1970. 7p.
Reference is made to systems for confining plasmas in experimental work on the achievement of a plasma of density, temperature and confinement time appropriate for sustaining a thermonuclear reaction. In the system described the plasma is confined in a toroidal configuration. A toroidal containment vessel is provided with solenoidal windings that provide the main confining toroidal magnetic field which extends around the torus parallel with the minor axis. Provision has to be made for stabilising the system, since the toroidal, magnetic field produced by the simple solenoidal windings is stronger nearer the major axis than it is further away, resulting in the plasma escaping by expanding until it collides with the outer wall of the containment vessel. The system is based on the fact that if the diffusion of plasma out of the confinement system exceeds a certain critical level there is a net plasma current around the major axis of the torus—also that the self-magnetic field of this current can be used to provide a major part of the constraining poloidal magnetic field. (UK)

11316 CROSSFIELD MAGNETOSONIC TWO STREAM INSTABILITY. Cipolla, J. W. Jr.; Golden, K. I. (Northeastern Univ., Boston). Can. J. Phys.; 53: No. 10, 1022-1024(15 May 1975).
A detailed analysis was made on the plasma magnetosonic instabilities whose propagation is perpendicular to the magnetic field and whose two streams cross the magnetic field during the time of development of the instability. The role of the magnetosonic instabilities in the structure of perpendicular shock waves was also studied. Since these instabilities are not stationary in the shock interior, one can ultimately deduce that they do not play a principal role in the structure. (auth)

Thermonuclear Engineering and Equipment

Refer also to abstracts 11188, 11199, and 12144.

11317 (AD-765476) ADVANCED ELECTRICAL POWER GENERATION AND DISTRIBUTION CONCEPTS FOR MILITARY FACILITIES. (Army Construction Engineering Research Lab., Champaign, Ill. (USA)). Jun 1973. 133p. (CERL-PR-E-13). NTIS $4.50.

Probable technical advancement of electrical power generation systems in the 1980 to 1990 time period for application in fixed or semi-fixed military facilities in the power range of 250 kW to 50,000 kW are described. Subjects include commercial power reliability, uninterruptible power system, conventional steam, diesel, gas turbine (open and closed cycle) generators and distribution systems for currently available equipment. Advanced power systems include nuclear reactors, batteries and fuel cells, magnetohydrodynamic systems, fusion systems, solar power systems and direct conversion systems of the thermoelectric and thermionic type. (GRA)

11318 (ANL/CTR-75-1) TECHNICAL CRITIQUE ON RADIATION TEST FACILITIES FOR THE CTR SURFACE AND MATERIALS PROGRAM. Persiani, P. J. (Argonne National Lab., Ill. (USA)). Feb 1975. Contract W-31-109-Eng-38. 57p. Dep. NTIS $5.45.

Major radiation test facilities will be necessary in the near-term (5 years) and long-term (greater than 10 years) future for the timely development and understanding of fusion confinement systems and of prototype fusion power reactors. The study includes the technical justifications and requirements for CTR Neutron and Plasma Radiation Test Facilities. The initial technical critique covers the feasibility and design problems: in upgrading the performance of the accelerator-rotating (solid T1T) target systems, and in transforming the accelerator-supersonic jet target concept into a radiation testing facility. A scoping assessment on the potential of a pulsed high-beta plasma device (dense plasma focus) is introduced to explore plasma concepts as near-term neutron and plasma radiation sources for the CTR Surface and Materials Program. (auth)

11319 (BNWL-SA-5419) POTENTIAL ROLE OF FISSION–FUSION SYSTEMS IN THE ELECTRIC ECONOMY. Deonigi, D. E. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jan 1975. 16p. (CONF-750607-17). Dep. NTIS $4.00.

From American Nuclear Society meeting; New Orleans, Louisiana, USA (8 Jun 1975).

This study was conducted in order to meet the following objectives: (1) define the target costs the hybrid must meet, (2) define the optimum fissile/electrical production ratio for hybrid blankets, (3) discover synergistic configurations, and (4) define the windows of economic hybrid design having desirable cost/benefit ratios. The techniques for conducting the study and some data are given. (MOW)

11320 (CONF-750607-23) MAGNETOHYDRODYNAMICS TEST OF A ONE-SIXTH SCALE MODEL OF A CTR RECIRCULATING LITHIUM BLANKET. Young, F. J.; Holcomb, R. S.; Fraas, A. P. (Oak Ridge National Lab., Tenn. (USA)). 1975. 28p. Dep. NTIS $4.50.

From American Nuclear Society meeting; New Orleans, Louisiana, USA (8 Jun 1975).

A one-sixth scale model of an element of a recirculating lithium blanket for a fusion reactor is tested experimentally. The model utilizes NaK 44. It is instrumented to measure flow, pressure drop and pumping power as a function of the applied magnetic field (0 to 4 T) and the pump current (0 to 300 amps dc). The flow is measured by an electromagnetic flow meter (the top set of electrodes) and by means of a buoyant capsule whose traverses are detected by the system of coils mounted on the lower part of the right leg of the loop. The pressure is measured by determining the liquid level in the head tanks located above the loop. (MOW)

11321 (HEDL-TME-75-24) CONTROLLED THERMONUCLEAR REACTOR. Quarterly Report, October, November, and December 1974. Doran, D. G.; Yoshikawa, H. H. (comps.). (Hanford Engineering Development Lab., Richland, Wash. (USA)). Feb 1975. Contract AT(45-1)-2170. 46p. Dep. NTIS $4.00.

The objective of this program is the correlation of irradiation effects produced in reactor and accelerator irradiation facilities for the prediction of materials performance in Controlled Thermonuclear Reactor environments. An initial emphasis of the program is the scoping of problem areas using simple analytical descriptions where appropriate. The displacement cross sections for charged-particle-out reactions in the 5 to 15 MeV range have been calculated for a number of metals; the contribution to the total displacement cross section from these reactions is significant for medium and low atomic number materials. The status of helium production cross sections, poorly known for many materials, is reviewed briefly as well as a program to produce an ENDF/B-V helium production file. A scoping study has begun of defect cluster annealing that can occur between burn pulses—annealing rates may be significant even in a Tokamak with a 95% duty cycle. An investigation of the effect on void nucleation of intrinsic cluster formation in energetic displacement cascades shows that a significant effect is possible under conditions characteristic of CTRs. (auth)

11322 (ORNL-TM-4933) CROSS-SECTION SENSITIVITY OF THE D-T FUSION PROBABILITY AND THE D-T AND T-T REACTION RATES. Santoro, R. T.; Barish, J. (Oak Ridge National Lab., Tenn. (USA)). Jul 1975. Contract W-7405-eng-26. 18p. Dep. NTIS $4.00.

The cross-section sensitivity of the fusion probability was calculated for various conditions of incident deuteron energy and plasma electron temperature. The fusion probability is most sensitive to the D-T cross section at the higher energies (greater than or equal to 50 keV), and, based on the reported errors in the cross section, the errors in the calculated fusion probabilities should be less than or equal to 10 percent. The cross-section sensitivities of the D-T reaction rate in a D-T plasma and the T-T reaction rate in a tritium plasma were also calculated for various assumed values of the plasma ion temperature. (auth)

11323 (UCRL-75826(Rev.1)) MODULARIZED MIRROR FUSION REACTOR CONCEPT WITH EMPHASIS ON FABRICABILITY, ASSEMBLY, AND DISASSEMBLY. Peterson, M. A.; Werner, R. W.; Hoffman, M. A.; Carlson, G. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 May 1975. 54p. (CONF-741017-35). Dep. NTIS $5.75.

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974).

A progress report on a continuing study directed toward the development of mirror reactor designs which simultaneously satisfy the various engineering, economic, and maintenance consideration is presented. Two new blanket and coil structure designs are presented which satisfy engineering requirements equally as well as previous designs while offering substantial gains in accessibility for maintenance. Because of the commercial requirement for a high duty cycle and the possible high frequency of blanket module removal--for either maintenance or replacement--the module removal must be accomplished quickly with a minimum disruption of reactor operations. The blanket and coil structure designs allow the removal of any one of the identical blanket modules without disturbing either the remaining modules or the coil and its associated support structure. With fabricated coil structure costs estimated at $2.50/lbm and the reactor net electrical power calculated from a plasma and reactor system model detailed in the paper, coil and support structure costs of between 100 to 200 $/kwe were estimated. (auth)

11324 (UCRL-76517) ANALYSIS OF A LASER-INITIATED, INERTIALLY-CONFINED REACTOR FOR A FUSION ENGINEERING RESEARCH FACILITY (LA FERF). Hovingh, J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 5 May 1975. 11p. (CONF-750531-6). Dep. NTIS $4.00.

From IEEE international conference on plasma science; Ann Arbor, Michigan, USA (14 May 1975).

With the increasing optimism for the viability of laser-induced, inertially-confined fusion-reactor power plants, comes an increased interest in a high flux 14-MeV neutron generator. This generator can be used to investigate 14-MeV neutron damage in first-wall material, and various neutron energy direct conversion schemes. The associated charged particles can be used to investigate various first-wall designs proposed for laser-fusion reactor systems as well as the direct conversion of charged particle energy by expansion of a fusion fireball against a magnetic field imposed from outside the neutron generator first wall. A systematic parameter study is made on a laser-initiated, inertially-confined reactor for a fusion engineering research facility (LA FERF). The parameters investigated are the variations of plant cost, plant power, and plant performance as a function of the fusion gain and power input to the laser system. Design point envelopes are presented for the laser input power and fusion gain (defined as the ratio of the thermonuclear power to power into the laser system) based on reference plant costs, powers, and performance. A design point was selected (based on technology available in the not-too-distant future) which produces a flux of 1.8×10^{18} n/m^2,s over an experimental area of approximately 1m^2 for a cost of 160 megadollars using a power of 140 MVA. A comparison is made with a current mirror FERF study proposed for use in CTR engineering studies. The LA FERF could be built in the mid 1980's using near-term short pulse CO_2 laser technology, producing thermonuclear power of 6 to 20 MW with fusion gains of approximately 0.1. (auth)

11325 ION-BEAM DEFLECTION IN EXTRACTION ELECTRODES. Coupland, J. R.; Green, T. S. (UKAEA Research

Group, Abingdon. Culham Lab.). Nucl. Instrum. Methods; 125: No. 1, 197-199(15 Mar 1975).

Experimental data for a single-aperture accel-decel electrode system showing the relationship between the angular deflection of a beam and the transverse shift of the extraction aperture is presented. A simple theory is derived which gives good agreement with the experimental data and may be used to predict beam deflection for other extractor geometries. (auth)

11326 DEVELOPMENT OF A MAGNETIC ENERGY STORAGE COIL ADAPTED TO A 5MJ HOMOPOLAR PULSE GENERATOR. Geoffrion, B.; Legentil, M. (Paris- 11 Univ., 91- Orsay (France). Lab. de Physique des Plasmas). Rev. Phys. Appl.; 10: No. 1, 11-16(Jan 1975). (In French).

A construction programme is presently developed for high power pulse generators for which the basic source is an iron-free self-excited homopolar generator. An energy storage coil is described and the experimental results obtained for the units already built are presented. The maximum energy stored is 1.5 MJ, the magnetic field is about 2.5 tesla in one cubic metre, the total time constant is 0,4 sec. (FR)

11327 SIMPLIFIED THEORY OF INDUCTIVE ENERGY TRANSFER SYSTEM OF HIGH EFFICIENCY. Rioux, C. (Paris-11 Univ., 91- Orsay (France). Lab. de Physique des Plasmas). Rev. Phys. Appl.; 10: No. 2, 75-79(Mar 1975). (In French).

A system using only inductances and opening and closing switches was developed to transfer energy from a storage inductance to any given load with a very high efficiency. Even higher efficiencies can be achieved if a number of small capacitors are used. (auth)

11328 TFTR: GENESIS, SYNTHESIS, AND RATIONALE. Grace, J. N. (Energy Research and Development Administration, Washington, DC). Trans. Am. Nucl. Soc.; 21: 9(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11329 PLASMA PHYSICS BASIS OF THE TFTR. Furth, H. P.; Jassby, D. L. (Princeton Univ., NJ). Trans. Am. Nucl. Soc.; 21: 9-10(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11330 CONCEPTUAL ENGINEERING DESIGN OF A TWO-COMPONENT TOKAMAK FUSION TEST REACTOR FACILITY. Varljen, T. C. (Westinghouse Electric Corp., Pittsburgh); Wakefield, K. E. Trans. Am. Nucl. Soc.; 21: 10-11(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11331 CONCEPTUAL MECHANICAL DESIGN OF THE TFTR DEVICE. French, J. W. (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc.; 21: 11-12(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11332 PRELIMINARY RADIATION ANALYSES OF THE TFTR. Gibson, G. (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc.; 21: 12-13(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11333 TOKAMAK FUSION REACTOR RESEARCH AND DEVELOPMENT PLAN. Dean, S. O. (Energy Research and Development Administration, Washington, DC). Trans. Am. Nucl. Soc.; 21: 14(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11334 NEUTRON DOWNSCATTERING IN DENSE FUSIONING PLASMAS. Southworth, F. H. (Univ. of Illinois, Urbana); Campbell, H. D. Trans. Am. Nucl. Soc.; 21: 15-16(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11335 ENERGY DEPOSITION RATES IN A LASER-FUSION REACTOR. Bosler, G. E.; Frank, T. G. (Los Alamos Scientific Lab., NM). Trans. Am. Nucl. Soc.; 21: 16-17(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11336 HYBRID CONCEPTS FOR LASER-INDUCED FUSION. Maniscalco, J. (Univ. of California, Livermore). Trans. Am. Nucl. Soc.; 21: 17-18(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11337 URANIUM AND THORIUM SHELLS SERVING AS TAMPERS OF DT-FUEL PELLETS FOR THE ELECTRON-BEAM-INDUCED FUSION APPROACH. Seifritz, W. (Swiss Federal Inst. for Reactor Research, Wuerenlingen, Switzerland); Naegele, H. Trans. Am. Nucl. Soc.; 21: 18-19(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11338 POWER BALANCE CONSIDERATIONS IN ELECTRON-BEAM-INDUCED FUSION POWER PLANTS. Varnado, S. G. (Sandia Labs., Albuquerque, NM). Trans. Am. Nucl. Soc.; 21: 19-20(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11339 FIRST-WALL PROTECTION CONCEPTS FOR AN ELECTRON-BEAM FUSION REACTOR. Carlson, G. A (Sandia Labs., Albuquerque, NM). Trans. Am. Nucl. Soc.; 21: 20(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11340 VACUUM PUMPING CONSIDERATIONS FOR ELECTRON-BEAM FUSION REACTORS. Hunter, T. O. (Sandia Labs., Albuquerque, NM). Trans. Am. Nucl. Soc.; 21: 21(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11341 ON HIGH-ENERGY (APPROX.1MJ) NUCLEAR-DRIVEN GAS LASER SYSTEMS. McArthur, D. A.; Schmidt, T. R.; Tollefsrud, P. B.; Philbin, J. S. (Sandia Labs., Albuquerque, NM). Trans. Am. Nucl. Soc.; 21: 21-22(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11342 NUCLEAR-INITIATED CHEMICAL LASER EXPERIMENTS. Miller, T. G. (Army Missile Command, Redstone Arsenal, AL); Dezenberg, G. J.; Morrison, G. W. Trans. Am. Nucl. Soc.; 21: 22-23(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11343 PRELIMINARY CONSIDERATIONS FOR A TOKAMAK ENGINEERING REACTOR WITH BEAM INJECTION. Conn, R. W. (Univ. of Wisconsin, Madison); Jassby, D. L. Trans. Am. Nucl. Soc.; 21: 24-25(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11344 ENERGY BALANCES FOR TOKAMAK PLASMA EXPERIMENTS AND REACTORS. Marcus, F. B.; McAlees, D. G.; Attenberger, S. E. (Oak Ridge National Lab., TN). Trans. Am. Nucl. Soc.; 21: 25(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11345 CONCEPTUAL ENGINEERING DESIGN STUDIES OF A FUSION EXPERIMENTAL POWER REACTOR. Sager, P. H. Jr.; Jonzen, M.; Kearney, D.; Thomas, R.; Toffolo, W.; Woods, T. (General Atomic Co., San Diego, CA). Trans. Am. Nucl. Soc.; 21: 25-27(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11346 NUCLEAR DESIGN OF BLANKET AND SHIELD FOR A TOKAMAK EXPERIMENTAL POWER REACTOR. Abdou, M. A. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 27-28(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11347 THETA-PINCH FUSION TEST REACTOR. Thomassen, K. I. (Los Alamos Scientific Lab., NM). Trans. Am. Nucl. Soc.; 21: 28-29(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11348 SHIELDING AND ACTIVATION OF A SCYLLAC FUSION TEST REACTOR (SFTR). Dudziak, D. J.; Gerstl, A. W. (Los Alamos Scientific Lab., NM). Trans. Am. Nucl. Soc.; 21: 29-30 (Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11349 STEADY-STATE AND PULSED OPERATING REGIMES FOR CTRs WITH LARGE POWER RATINGS. Usher, J. L.; Powell, J. R. (Brookhaven National Lab., Upton, NY). Trans. Am. Nucl. Soc.; 21: 30-31(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11350 SYSTEM STUDIES OF THE IMPLEMENTATION OF FUSION. Beardsworth, E.; Powell, J. (Brookhaven National Lab., Upton, NY). Trans. Am. Nucl. Soc.; 21: 31-32(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11351 ENGINEERING PLASMA PHYSICS CONSIDERATIONS FOR A TOKAMAK EXPERIMENTAL POWER REACTOR. Stacey, W. M. Jr.; Evans, K. Jr.; Bertoncini, P. J.; Brooks, J. N. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 32-33 (Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11352 HIGH-ENERGY ION RING COMPRESSOR AS FUSION REACTOR. Fleischmann, H. H. (Cornell Univ., Ithaca, NY); Kammash, T. Trans. Am. Nucl. Soc.; 21: 34(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11353 HEAT TRANSFER AND NEUTRONICS OF PARTIAL ISSEC AND ISSEC BLANKET DESIGNS. Sze, D. K.; Conn, R. W. (Univ. of Wisconsin, Madison). Trans. Am. Nucl. Soc.; 21: 34-35 (Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11354 APPLICATION OF PARTITIVE ANALYTICAL FORECASTING (PAF) TO CTR MAGNET DEVELOPMENT. Nichols, S. P.; Vanston, J. H. (Univ. of Texas, Austin). Trans. Am. Nucl. Soc.; 21: 35-36(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11355 LIQUID-METAL HEAT TRANSFER IN PIPES WITH ALIGNED MAGNETIC FIELDS. Lykoudis, P. S.; Andelman, M. (Purdue Univ., West Lafayette, IN). Trans. Am. Nucl. Soc.; 21: 36-37(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11356 MAGNETOHYDRODYNAMICS TEST OF ONE-SIXTH SCALE MODEL OF A CTR RECIRCULATING LITHIUM BLANKET. Young, F. J. (Oak Ridge National Lab., TN); Holcomb, R. S.; Fraas, A. P. Trans. Am. Nucl. Soc.; 21: 37-38(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11357 TOKAMAK EXPERIMENTAL POWER REACTOR: SCOPING STUDIES. Haubenreich, P. N. (Oak Ridge National Lab., TN); McAlees, D. G.; Roberts, M. Trans. Am. Nucl. Soc.; 21: 41(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11358 CONTROLLED FUSION RESEARCH: HIGHLIGHTS OF THE TOKYO IAEA CONFERENCE AND SUBSEQUENT DEVELOPMENTS. Ribe, F. L. (Los Alamos Scientific Lab., NM). Trans. Am. Nucl. Soc.; 21: 42(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11359 THERMAL INSTABILITY AND CONTROL FOR CTR FUEL CYCLES. Campbell, H. D. (Univ. of Florida, Gainesville); Usher, J. L. Trans. Am. Nucl. Soc.; 21: 45-46(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11360 VOLT-SECOND REQUIREMENTS FOR NONCIRCULAR TOKAMAKS. Harder, C. R.; Miller, P. H. Jr. (General Atomic Co., San Diego, CA). Trans. Am. Nucl. Soc.; 21: 46-47(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11361 CROSS-SECTION SENSITIVITY OF THE D-T FUSION PROBABILITY AND THE D-T AND T-T REACTION RATES. Santoro, R. T.; Barish, J. (Oak Ridge National Lab., TN). Trans. Am. Nucl. Soc.; 21: 47-48(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11362 ISSEC FUSION BLANKET DESIGN CONCEPTS. Conn, R. W.; Kulcinski, G. L. (Univ. of Wisconsin, Madison). Trans. Am. Nucl. Soc.; 21: 49-50(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11363 PROTECTION OF CTR METALLIC FIRST WALLS BY NEUTRON SPECTRAL SHIFTING. Kulcinski, G. L.; Conn, R. W.; Avci, H. I.; Sze, D. K. (Univ. of Wisconsin, Madison). Trans. Am. Nucl. Soc.; 21: 50(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11364 PULSED GRAPHITE BLANKET CONCEPT. Powell, J. R.; Lazareth, O. W.; Tichler, P. (Brookhaven National Lab., Upton, NY). Trans. Am. Nucl. Soc.; 21: 50-51(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11365 MINIMUM ACTIVITY ALUMINUM REFERENCE DESIGN. Lazareth, O. W.; Powell, J. R.; Benenati, R.; Fillo, J.; Majeski, S.; Sheehan, T. V. (Brookhaven National Lab., Upton, NY). Trans. Am. Nucl. Soc.; 21: 51-53(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11366 SURFACE PHYSICS AND TECHNOLOGY PROGRAM AT ORNL: FIRST-WALL IMPURITIES IN ORMAK. Colchin, R. J.; Clausing, R. E.; Cramer, S. N.; Obiow, E. M. (Oak Ridge National Lab., TN). Trans. Am. Nucl. Soc.; 21: 53(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11367 HEAT TRANSFER ANALYSIS OF A FIRST-WALL RADIATION SHIELD FOR A FUSION REACTOR. Patten, J.; Coultas, T. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 53-54(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11368 FUSION REACTOR FIRST WALLS: LOW ATOMIC NUMBER MATERIALS. Hopkins, G.; Kearney, D.; Rovner, L. (General Atomic Co., San Diego, CA). Trans. Am. Nucl. Soc.; 21: 54(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11369 CONCEPTUAL DESIGN OF A MIRROR HYBRID FUSION-FISSION REACTOR. Moir, R. W.; Lee, J. D.; Burleigh, R. C.; Barr, W. L.; Fink, J. H.; Hamilton, G. W.; Bender, D. J.; Carlson, G. A.; Dexter, W. L.; Holdren, J.; Folkers, C. L.; Peterson, M. A. (Univ. of California, Livermore). Trans. Am. Nucl. Soc.; 21: 55(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11370 SELECTION OF OPTIMUM HYBRID (FUSION-FISSION) REACTORS. Wolkenhauer, W. C. (Washington Public Power Supply Syst, Richlant). Trans. Am. Nucl. Soc.; 21: 55-58(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11371 POTENTIAL ROLE OF FISSION-FUSION SYSTEMS IN THE ELECTRIC ECONOMY. Deonigi, D. E. (Battelle Pacific Northwest Labs., Richland, WA). Trans. Am. Nucl. Soc.; 21: 58(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11372 PRODUCTION OF ^{233}U IN HYBRID FUSION REACTOR BLANKETS. Parish, T. A.; Spangler, R. S. (Univ. of Texas, Austin). Trans. Am. Nucl. Soc.; 21: 58-60(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11373 SYMBIOSIS: OPTIMIZATION OF THE NUCLEAR FUEL CYCLE. Lidsky, L. M. (Massachusetts Inst. of Tech., Cambridge). Trans. Am. Nucl. Soc.; 21: 60(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11374 OPTIMAL PLASMA CONDITIONS FOR DRIVEN TOKAMAK FUSION-FISSION HYBRID REACTORS. Jassby, D. L. (Princeton Univ., NJ). Trans. Am. Nucl. Soc.; 21: 60-61(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11375 ENGINEERING DESIGN OF A LINEAR THETA-PINCH HYBRID REACTOR (LTPHR). Krakowski, R. A.; Dudziak, D. J.; Oliphant, T. A.; Thomassen, K. I. (Los Alamos Scientific Lab., NM). Trans. Am. Nucl. Soc.; 21: 61-62(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11376 PLASMA REQUIREMENTS FOR FUSION–FISSION HYBRIDS. Miley, G. H. (Univ. of Illinois, Urbana). Trans. Am. Nucl. Soc.; 21: 63-64(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11377 FISSION–FUSION SYMBIOSIS IN HIGHLY COMPRESSED MICROSPHERES. Krumbein, A. D. (Soreq Nuclear Research Center, Yavne, Israel). Trans. Am. Nucl. Soc.; 21: 64(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11378 NEUTRONIC AND THERMAL-HYDRAULIC ANALYSIS OF A FAST FISSION BLANKET FOR A FUSION REACTOR. Bender, D. J.; Lee, J. D. (Univ. of California, Livermore). Trans. Am. Nucl. Soc.; 21: 64-66(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11379 NEUTRON WALL LOAD DISTRIBUTIONS IN TOKAMAKS. Chapin, D. L.; Price, W. G. Jr. (Princeton Univ., NJ). Trans. Am. Nucl. Soc.; 21: 66-67(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11380 RECOIL SPECTRA, DAMAGE ENERGY, AND DISPLACEMENT CROSS SECTIONS. Gabriel, T. A.; Amburgey, J. D.; Greene, N. M. (Oak Ridge National Lab., TN). Trans. Am. Nucl. Soc.; 21: 67-68(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting New Orleans LA; New Orleans, LA (8 Jun 1975).

11381 QUANTITATIVE BASIS FOR CROSS-SECTION REQUIREMENTS FOR A FUSION TEST REACTOR. Gerstl, S. A. W.; Dudziak, D. J.; Muir, D. W. (Los Alamos Scientific Lab., NM). Trans. Am. Nucl. Soc.; 21: 68-69(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11382 CORRELATION OF REACTION RATES IN URANIUM METAL USING A 14-MeV NEUTRON SOURCE. Newman, D. F.; Leonard, B. R. Jr. (Battelle Pacific Northwest Labs., Richland). Trans. Am. Nucl. Soc.; 21: 69-70(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11383 GAMMA-RAY STRENGTH FUNCTIONS FROM NEUTRON CAPTURE-GAMMA-RAY SPECTRA. Gardner, D. G. (Univ. of California, Livermore). Trans. Am. Nucl. Soc.; 21: 70-71(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11384 CALCULATED COMPOSITION CHANGES OF SOME FUSION REACTOR FIRST WALLS. Kopecki, D. S.; Ralls, K. M.; Draper, E. L. Jr. (Univ. of Texas, Austin). Trans. Am. Nucl. Soc.; 21: 159-160(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11385 COMPARISON OF RADIATION-ENHANCED DIFFUSION CAUSED BY 14-MeV REACTOR NEUTRONS AND FISSION FRAGMENTS. Borg, R. J.; Dienes, G. J. (Univ. of California, Livermore). Trans. Am. Nucl. Soc.; 21: 167(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11386 HYDROGEN ISOTOPE–LITHIUM SYSTEMS. Smith, F. J.; Land, J. F. (Oak Ridge National Lab., TN). Trans. Am. Nucl. Soc.; 21: 167-168(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11387 NEW CONCEPTS FOR CONTROLLED FUSION REACTOR BLANKET DESIGN. Conn, R. W.; Kulcinski, G. L.; Avci, H.; El-Maghrabi, M. (Univ. of Wisconsin, Madison). Nucl. Technol.; 26: No. 2, 125-145(Jun 1975).
Several new concepts for fusion reactor blanket design based on the idea of shifting, or tailoring, the neutron spectrum incident on the first structural wall are presented. The spectral shifter is a nonstructural element which can be made of graphite, silicon carbide, or three dimensionally woven carbon fibers (and containing other materials as appropriate) placed between the neutron source and the first structural wall. The softened neutron spectrum incident on the structural components leads to lower gas production and atom displacement rates than in more standard fusion blanket designs. In turn, this results in longer anticipated lifetimes for the structural materials and can significantly reduce radioactivity and afterheat levels. In addition, the neutron spectrum in the first structural wall can be made to approach the flux shape in fast breeder reactors. Such spectral softening means that existing radiation facilities may be more profitably used to provide relevant materials radiation damage data for the structural materials in these fusion blanket designs. This general class of blanket concepts are referred to as internal spectral shifter and energy converter, or ISSEC concepts. These specific design concepts fall into three main categories: ISSEC/EB concepts based on utilizing existing designs which breed tritium behind the first structural wall; ISSEC/IB concepts based on breeding tritium inside the first vacuum wall; and ISSEC/Bu concepts based on using boron, carbon, and perhaps, beryllium to obtain an energy multiplier and converter design that does not attempt to breed tritium or utilize lithium. The detailed analyses relate specifically to the nuclear performance of ISSEC systems and to a discussion of materials radiation damage problems in the structural materials. (auth)

Wave Phenomena

11388 (CONF-750224-) PROCEEDINGS OF THE U.S.–AUSTRALIAN WORKSHOP ON PLASMA WAVES, SYDNEY, CANBERRA, AND ADELAIDE, AUSTRALIA, FEBRUARY 13–18, 1975. Cross, R. C. (ed.). (Sydney Univ. (Australia)). Mar 1975. 185p.
Separate abstracts were prepared for the 33 included papers. (MOW)

For abstracts of individual papers see: 11271–11278, 11284, 11285, 11293, 11297–11299, 11310, 11311, and 11389–11405.

11389 (CONF-750224-, pp 2.1-2.6) MODE CONVERSION OF TOROIDAL ALFVEN WAVES. Swanson, D. G. (Univ. of Southern California, Los Angeles). Mar 1975.
From proceedings of the U.S.-Australian workshop on plasma waves; Sydney, Canberra, and Adelaide, Australia (13 Feb 1975).
In proceedings of the U.S.–Australian workshop on plasma waves. (Sydney Univ. (Australia)).
When electron inertia is neglected in the toroidal magnetic field wave equation, the fields are singular whereas when electron inertia is included, the ion cyclotron wave is shown to mode convert into an electrostatic wave propagating back towards the inside of the torus with cold electrons but to the electrostatic ion cyclotron wave propagating beyond the mode conversion layer with warm electrons. Without damping, both lead to a discrete spectrum of eigenfrequencies, but with only weak Landau damping, the electrostatic waves are absorbed and one obtains a continuous spectrum of frequencies. (auth)

11390 (CONF-750224-, pp 3.1-3.4) QUASI-STATIC MODES OF OSCILLATION OF A COLD TOROIDAL PLASMA. Love, J. D. (Australian National Univ., Canberra). Mar 1975.
From proceedings of the U.S.-Australian workshop on plasma waves; Sydney, Canberra, and Adelaide, Australia (13 Feb 1975).
In proceedings of the U.S.–Australian workshop on plasma waves. (Sydney Univ. (Australia)).
A uniform cold plasma ring of major radius R, minor radius a and dielectric constant $\epsilon = 1-\omega^2/\omega_p^2$ is considered. In the quasi-static approximation the electric field potentials are solutions of Laplace's equation. The system of toroidal coordinates generates separable but non-orthogonal toroidal harmonics which, when applied to continuity conditions at the plasma-vacuum interface, lead to a recurrence relation between contiguous mode amplitudes that is solved in terms of a continued fraction. The exact dispersion relation is valid for all aspect ratios. (auth)

11391 (CONF-750224-, pp 6.1-6.6) HELICAL ANTENNA FOR EXCITING AZIMUTHALLY-ASYMMETRIC ALFVEN WAVES. Knox, S. O.; Paoloni, F. J.; Kristiansen, M.; Hagler, M. O. (Texas Tech. Univ., Lubbock). Mar 1975.
From proceedings of the U.S.-Australian workshop on plasma waves; Sydney, Canberra, and Adelaide, Australia (13 Feb 1975).
In proceedings of the U.S.–Australian workshop on plasma waves. (Sydney Univ. (Australia)).
A new coupler for exciting azimuthally-asymmetric Alfvén waves was experimentally investigated. The coupler consists of four symmetric helical straps wound around a 30 cm length of the vacuum vessel, and is powered by a four-phase rf source. Waves excited by the coupler vary azimuthally as $e^{jm\theta}$, where m can be chosen to be exclusively either +1 or −1. The coupler exhibits both a broadband capability and a high degree of propagation directionality. Measurements of coil loading indicate a factor of 2-3 increase in coupler resistance with plasma present. This increase is dependent on the excitation frequency and the sign of m. The m = −1 wave was found to propagate above and below

ω_{ci} and was identified as the fast wave. The absence of the expected waveguide cutoff for this wave is explained from boundary layer calculations. The m = +1 wave was observed only below ω_{ci} as the slow wave. The m = +1 fast wave and the m = −1 slow wave were not observed due to the poor coupling efficiency to these waves, as is also predicted by theoretical calculations. (auth)

11392 (CONF-750224-, pp 9.1-9.4) MAGNETOACOUSTIC WAVES IN A HYDROGEN PLASMA. Brennan, M. H.; Jessup, B. L.; Jones, I. R. (Flinders Univ. of South Australia, Bedford Park). Mar 1975.

From proceedings of the U.S.-Australian workshop on plasma waves; Sydney, Canberra, and Adelaide, Australia (13 Feb 1975).

In proceedings of the U.S.–Australian workshop on plasma waves. (Sydney Univ. (Australia)).

The magnetoacoustic oscillations of cylindrical plasma columns have been investigated by a number of workers. In particular, Frommelt and Jones have recently used such oscillations to obtain information about the characteristics of an argon afterglow plasma. In their theoretical calculations, Frommelt and Jones took account of the influence of radial variations in ion density on the characteristics of magnetoacoustic oscillations. The study is extended here to include the effects of radial variations in plasma parameters by considering magnetoacoustic oscillations in a hydrogen afterglow plasma, taking into account the measured ion density profile and possible radial variations in neutral atom density. (auth)

11393 (CONF-750224-, pp 10.1-10.4) DAMPING AND PLASMA HEATING WITH THE FAST WAVE. Dollinger, R.; Kristiansen, M.; Hagler, M. O.; Bergstrom, J.; Paoloni, F. J. (Texas Tech. Univ., Lubbock). Mar 1975.

From proceedings of the U.S.-Australian workshop on plasma waves; Sydney, Canberra, and Adelaide, Australia (13 Feb 1975).

In proceedings of the U.S.–Australian workshop on plasma waves. (Sydney Univ. (Australia)).

Anomalous wave damping and plasma heating were observed for the fast (right-hand polarized) wave at a frequency equal to 1.6 times the ion cyclotron frequency, Ω_i. The anomalous wave damping is seen to be very strong and very sharp. This anomalous damping and heating is believed to be the result of a magnetosonic column resonance. The fast wave is also observed to damp at the second harmonic of the ion cyclotron frequency. (auth)

11394 (CONF-750224-, pp 11.1-11.4) ALFVEN WAVE PROPAGATION IN A SPATIALLY PERIODIC AXISYMMETRIC MAGNETIC FIELD. Blackwell, B. D.; Cramer, N. F.; Lehane, J. A. (Univ. of Sydney). Mar 1975.

From proceedings of the U.S.-Australian workshop on plasma waves; Sydney, Canberra, and Adelaide, Australia (13 Feb 1975).

In proceedings of the U.S.–Australian workshop on plasma waves. (Sydney Univ. (Australia)).

Hydromagnetic wave propagation in an inhomogeneous magnetic field has been most widely studied for the case of torsional waves propagating into a magnetic "beach" where ion cyclotron resonance is encountered. Measurements in other circumstances have been presented by Lehane and Paoloni (1970a). They report on torsional waves propagating into magnetic "beaches" both for the case in which ion cyclotron resonance is encountered and for that in which it is not. As well they report on compressional waves propagating into magnetic "cliffs". It is shown that the propagation of hydromagnetic waves for this case is formally analogous to that of such waves propagating into a periodically time-varying magnetic field. (MOW)

11395 (CONF-750224-, pp 13.1-13.7) ADDITIONAL LONGITUDINAL ELECTRON WAVE MODES IN PLASMA. Bydder, E. L. Mar 1975.

From proceedings of the U.S.-Australian workshop on plasma waves; Sydney, Canberra, and Adelaide, Australia (13 Feb 1975).

In proceedings of the U.S.–Australian workshop on plasma waves. (Sydney Univ. (Australia)).

The propagation of longitudinal electron waves in plasma at frequencies above ω_{pe} is well known (Jackson (1960), Malmberg and Wharton (1964)). In this paper it is shown that there are (at least) two propagating mode solutions of the Landau dispersion equation. The second mode, i.e., that not given by Jackson, propagates at all frequencies and has interesting damping properties. The properties of this mode appear to be consistent with the experiments of Henry and Treguier (1972) who showed the propagation of longitudinal electronic modes at frequencies well below ω_{pe}. (auth)

11396 (CONF-750224-, pp 14.1-14.5) CONNECTION BETWEEN RESONANCE CONES AND GUIDED MODES IN ANISOTROPIC PLASMA. Gould, R. W. (California Inst. of Tech., Pasadena). Mar 1975.

From proceedings of the U.S.-Australian workshop on plasma waves; Sydney, Canberra, and Adelaide, Australia (13 Feb 1975).

In proceedings of the U.S.–Australian workshop on plasma waves. (Sydney Univ. (Australia)).

In an anisotropic plasma, where the perpendicular and parallel elements of the cold plasma dielectric tensor ($K_\perp$ and $K_\parallel$) have opposite signs, the equation describing the propagation of electrostatic disturbances is hyperbolic and disturbances propagate along characteristics. This gives rise to the "resonance cone" phenomenon when the source is spatially localized. On the other hand, plasma columns and slabs are known to support guided-wave modes under the same conditions. The relationship between these two rather differently appearing phenomena is explored and it is shown that electrostatic disturbances from a localized source in plasma slab can be thought of either as a series of multiply reflected (from the slab boundaries) resonance cones, or as a superposition of guided-wave modes. Depending on the source size and importance of dissipation, one of the other points of view may be more useful. (auth)

11397 (CONF-750224-, pp 15.1-15.4) ENERGY MOMENTUM TENSOR FOR AN ELECTROMAGNETIC WAVE PACKET IN A RELATIVISTIC UNMAGNETIZED PLASMA. Dewar, R. L. (Australian National Univ., Canberra). Mar 1975.

From proceedings of the U.S.-Australian workshop on plasma waves; Sydney, Canberra, and Adelaide, Australia (13 Feb 1975).

In proceedings of the U.S.–Australian workshop on plasma waves. (Sydney Univ. (Australia)).

There has been recent interest in the problem of momentum transport by wavepackets, both from a general point of view, and in plasmas. In these works it is assumed that the energy flux S is related to the total energy density W by multiplying by the group velocity v_g: $S = Wv_g$. On the other hand, it has been shown previously that this relation does not apply in the case of hydromagnetic waves. In this paper we treat a hot, collisionless plasma with no strong magnetic field. A 4-vector formalism is employed in order to keep the relativistic transformation properties of the problem transparent. In the limit of a cold plasma, it is found that the above equation is satisfied in those frames of reference where the wavevector k and the plasma velocity U are parallel. (MOW)

11398 (CONF-750224-, pp 18.1-18.4) FINITE AMPLITUDE EFFECTS IN THE PROPAGATION OF A m = 0 TORSIONAL HYDROMAGNETIC WAVE. Brennan, M. H.; Cheetham, A. D.; Jones, I. R. (Flinders Univ. of South Australia, Bedford Park). Mar 1975.

From proceedings of the U.S.-Australian workshop on plasma waves; Sydney, Canberra, and Adelaide, Australia (13 Feb 1975).

In proceedings of the U.S.–Australian workshop on plasma waves. (Sydney Univ. (Australia)).

The results of a theoretical and experimental investigation of second order nonlinear effects in the propagation of an azimuthally symmetric torsional hydromagnetic wave are studied. (auth)

11399 (CONF-750224-, pp 19.1-19.4) THREE-DIMENSIONAL STABILITY ANALYSIS FOR COUPLED WAVES. Bers, A. (Massachusetts Inst. of Tech., Cambridge). Mar 1975.

From proceedings of the U.S.-Australian workshop on plasma waves; Sydney, Canberra, and Adelaide, Australia (13 Feb 1975).

In proceedings of the U.S.–Australian workshop on plasma waves. (Sydney Univ. (Australia)).

It is shown how the time-asymptotic pulse shape in three dimensions can be calculated for unstable wave–wave interactions. (auth)

11400 (CONF-750224-, pp 21.1-21.6) PARTICLE CORRELATIONS AND NON-LINEAR WAVE INTERACTIONS. Cadusch, P. J. (Univ. of Melbourne). Mar 1975.

From proceedings of the U.S.-Australian workshop on plasma waves; Sydney, Canberra, and Adelaide, Australia (13 Feb 1975).

In proceedings of the U.S.–Australian workshop on plasma waves. (Sydney Univ. (Australia)).

An attempt was made to establish a class of approximate Lagrangians, which include particle correlations up to some given level, by deriving them from an ensemble average of an exact Lagrangian. The formal theory thus developed has the advantage of being a close parallel of the collisionless theory. (MOW)

11401 (CONF-750224-, pp 22.1-22.6) SOME COMPUTATIONAL STUDIES OF NONLINEAR PLASMA WAVES. Matsuda, Y.; Crawford, F. W. (Stanford Univ., CA). Mar 1975.

From proceedings of the U.S.-Australian workshop on plasma waves; Sydney, Canberra, and Adelaide, Australia (13 Feb 1975).

In proceedings of the U.S.–Australian workshop on plasma waves. (Sydney Univ. (Australia)).

A low-noise simulation model is applied to a series of problems associated with electrostatic wave propagation in a one-dimensional, collisionless, Maxwellian plasma, in the absence of magnetic field. The model is first shown to be capable of verifying the linear dispersion relation at wave energy levels as low as 10^{-6} of the plasma thermal energy. It is then used to study the nonlinear dynamics of a monochromatic wave, sideband instability, and satellite growth. Simulations are presented for parameter ranges allowing comparison with available theories and readily accessible to experiment. (auth)

11402 (CONF-750224-, pp 23.1-23.4) REFLECTION OF ION-ACOUSTIC WAVES AT DISCHARGE-TUBE WALLS. Alexeff, I. (Univ. of Tennessee, Knoxville); Gary, S. P. Mar 1975.

From proceedings of the U.S.-Australian workshop on plasma waves; Sydney, Canberra, and Adelaide, Australia (13 Feb 1975).

In proceedings of the U.S.–Australian workshop on plasma waves. (Sydney Univ. (Australia)).

A simple model is used to show that ion-acoustic waves impinging on a subsonic-supersonic discontinuity in a plasma should be reflected in phase and with relatively high efficiency. The reflection coefficient is a function of upstream to downstream flow velocity, becoming unity when the downstream flow approaches infinity. The model is used to explain the observed "organ-pipe" mode of ion-acoustic waves in discharge-tube plasmas. In addition, the model predicts that two downstream waves should exist, and gives their amplitudes. (auth)

11403 (CONF-750224-, pp 31.1-31.4) EFFECTS OF PRE-IONIZATION LEVEL ON THE STRUCTURE OF MHD SHOCKS. Collins, A. R. (Univ. of Sydney). Mar 1975.

From proceedings of the U.S.-Australian workshop on plasma waves; Sydney, Canberra, and Adelaide, Australia (13 Feb 1975).

In proceedings of the U.S.–Australian workshop on plasma waves. (Sydney Univ. (Australia)).

Studies of shock structure previously obtained on SUPPER II indicate that the principal heating process in ionizing shocks is ion-neutral collisions. This series of experiments extends this work to examine the effects on shock structure of varying the neutral component in the upstream plasma. Four shocks were studied and their method of preparation differed only in the level of preionization. T_e, T_i, n_e, B_0 profiles were obtained for four shocks and these profiles compared. (auth)

11404 (CONF-750224-, pp 32.1-32.4) SWITCH-ON SHOCK WAVES IN A PARTIALLY IONIZED GAS. Cramer, N. F. (Univ. of Sydney). Mar 1975.

From proceedings of the U.S.-Australian workshop on plasma waves; Sydney, Canberra, and Adelaide, Australia (13 Feb 1975).

In proceedings of the U.S.–Australian workshop on plasma waves. (Sydney Univ. (Australia)).

Recent experimental studies of the structure of switch-on MHD shock waves have led to the conclusion that the plasma possesses an anomalously high resistivity, attributed to the ion-acoustic instability. An alternative, or additional, mechanism is the effect of ion-neutral charge exchange collisions, if the upstream gas is not fully ionized. Recent detailed measurements of the structure of an ionizing switch-on shock in helium have indicated that the structure is dominated by ion-neutral relative flow and consequent dissipation. In the MHD shock experiments, if the neutrals remain unionized over the first few periods of the upstream whistler, ion-neutral collisions will act to damp the upstream whistler and heat the ions and neutrals. (auth)

11405 (CONF-750224-, pp 33.1-33.5) ION CURRENTS IN LABORATORY PLASMAS. Millar, D. D. (Univ. of Sydney). Mar 1975.

From proceedings of the U.S.-Australian workshop on plasma waves; Sydney, Canberra, and Adelaide, Australia (13 Feb 1975).

In proceedings of the U.S.–Australian workshop on plasma waves. (Sydney Univ. (Australia)).

Unlike a liquid metal or the incompressible, single, conducting, fluid of many MHD treatments, a plasma comprises two intermingled gases of ions and of electrons each accelerated more or less independently of the other by electric and magnetic fields. Plasma currents may therefore be carried predominantly by ions rather than by electrons. Alfvén waves and ionizing shocks are examples where ion currents play a dominant role. (auth)

11406 (UCID-16737) COUPLING OF MAGNETIZED PLASMA OSCILLATIONS TO ELECTROMAGNETIC RADIATION. Kelly, D. L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 17 Apr 1975. Contract W-7405-Eng-48. 12p. Dep. NTIS $4.00.

A preliminary theoretical study was made of the coupling of magnetized plasma oscillations with frequency omega less than electron-cyclotron frequency omega/sub ce/ to circularly polarized electromagnetic (EM) waves in an inhomogeneous plasma modeled by a cold electron fluid. The external magnetic field makes an angle theta with the density gradient Nabla n_0. The differential equations which determine the fields are decoupled by an approximation which requires that the scale length of the density inhomogeneity be small compared to the free space wavelength of the EM waves. Via WKBJ approximation solutions are given for the magnetized plasma wave away from a resonance at omega^2/sub pe//omega^2 equals (1 – omega^2/omega^2/sub ce)/(cos^2 theta – omega^2/omega^2/sub ce), where omega/sub pe/ is electron plasma frequency, and this solution is matched to an integral solution in the resonance region in which the density is taken as a linear function of distance. The magnetized plasma wave in the resonance region determines the amplitude of the EM radiation. The coupling is strongest when the magnetized plasma wave propagates down the density gradient to give an EM wave amplitude conversion ratio of pi/sup 1/2/sin theta (cos^2 theta + omega/omega/sub ce/)/sup 1/2//(cos^2 theta – omega^2/omega^2/sub ce/)/sup 1/2/. (auth)

11407 OBSERVATIONS OF A NONLINEAR INTERACTION INVOLVING THREE ELECTROMAGNETIC WAVES IN A LABORATORY MAGNETOPLASMA. Christiansen, P. J.; Giles, M. J.; Martelli, G.; Wells, N. D. (Univ. of Sussex, Eng.). Nature (London).; 254: No. 5502, 683-685(24 Apr 1975).

It is stated that polarisation requirements and wave number matching require that a nonlinear interaction involving three electromagnetic waves propagating in a magnetoactive plasma must be two-dimensional if one of the waves propagates parallel to the external magnetic field. What is believed to be the first observation of a three-wave interaction of this kind is here reported. The experimental work involved the production of a whistler mode wave through the interaction of two beams of high frequency electromagnetic waves, propagating somewhat above the local plasma frequency. The laboratory plasma was produced by transverse r.f. excitation of Ar in a glass tube immersed in a variable axial magnetic field. A motor driven probe was used for the detection of the wave field along the tube axis. The two microwave beams were derived from two Klystron oscillator and amplifier systems, and fed into the plasma through horn antennae. The original motivation for this experiment was to verify the theoretical predictions concerning the feasibility of a field experiment to excite whistler mode waves in the Earth's ionosphere by means of two ground based high frequency transmitters of equal beam strengths, and the laboratory measurements are extrapolated to the ionospheric situation. Applications of the findings to Ariel satellite observations are also mentioned. (UK)

11408 RECENT DEVELOPMENTS IN SHOCK TUBE RESEARCH. Proceedings of the Ninth International Shock Tube Symposium, Stanford, California, July 16–19, 1973. Bershader, D.; Griffith, W. (eds.). Stanford, CA; Stanford University Press (1973). 844p. (CONF-730752-). $27.50.

This symposium provided a forum for discussing a wide variety of current problems as well as pointing up the implications of past accomplishments in the field. Several challenging new directions were revealed by the papers. Some of the papers cover discussions on gas lasers, sonic booms and the propagation of sound in the cochlea of the ear, extension of chemical kinetic measurements to both very low and very high temperature, and applications to the complex problems of gas-particle interactions encountered in air pollution by soot and aerosols. (MOW)

ENGINEERING

Energy Conversion

Refer also to abstracts 11596 and 11664.

11409 (INSD-2062-6-69(Vol.I)) SNAP 29 POWER SUPPLY SYSTEM, FINAL REPORT. Vol. I. (Isotopes, Inc., Middle River, Md. (USA). Nuclear Systems Div.). Jun 1969. Contract AT(29-2)-2062. 425p. Dep. NTIS $24.25.

Declassified 6 Sep 1973.

The major aspects of the SNAP-29 radioisotope thermoelectirc generator are presented. The radioisotope thermoelectric generator system, including an overall system description, the design criteria, and heat balance and generator characteristics data is described. The system is broken down to describe each subsystem and how it functions, the criteria on which the design is based, and the design performance. Included are data on analytical studies, test results, materials technology, and assembly sequences. Areas requiring further development are identified. Also included are reliability data, system application data, and the results of an alternate heat source study. (TFD)

11410 (MND-3241) DESIGN SUMMARY OF ISOTOPE: THERMOELECTRIC GENERATORS. Nichols, W. K. Jr. (Martin Marietta Corp., Baltimore, Md. (USA)). Nov 1965. 147p. Dep. NTIS $10.50.

Declassified 30 Aug 1973.

Design and specifications for radioisotope thermoelectric generators developed by the Martin Marietta Corporation are summarized. The generators include SNAP-1, SNAP-1A, SNAP-3, SNAP-5, SNAP-7, SNAP-7A, SNAP-7B, SNAP-7C, SNAP-7D, SNAP-7E, SNAP-7F, SNAP-9A, SNAP-11, SNAP-17A, SNAP-19, SNAP-21A, space generators used with Transit 4A and 4B (similar to SNAP-3), Axel Heiberg weather station power supply, IMP-space power supply for interplantetary monitoring probe, low-cost generator (LCG 25A), 250 watt study, and Apollo. (TFD)

11411 (SC-PR-67-204) SPACE ISOTOPE POWER PROGRAM MONTHLY REPORT, FEBRUARY 1967. (Sandia Labs., Albuquerque, N. Mex. (USA)). Mar 1967. 30p. Dep. NTIS $4.50.

Declassified 23 Jun 1972.

Progress during February 1967 in the development of SNAP-19, -27, and -29 batteries and ISOTEC modules for spacecraft power systems is reported. (LCL)

11412 (TID/SNG-6) UNI-DIRECTIONAL HEAT REJECTION RTG PARAMETRIC STUDY, VOYAGER TASK C. (General Electric Co., Philadelphia, Pa. (USA). Missile and Space Div.). 30 Dec 1966. 71p. Dep. NTIS $6.75.

For Jet Propulsion Lab., Pasadena, CA. Declassified 21 Jun 1972.

The weight, size, operating conditions, and performance of RTG's designed for uni-directional heat rejection and intact re-entry are presented. The fuel capsule and thermopile are based on SNAP-27 technology. The headlight shaped appearance is a result of an attempt to minimize thermal interactions between the RTG and the spacecraft body. The range of RTG's considered in this report is between 50 W(e) and the largest size which can be accommodated within a 48-in. dia envelope. This upper limit corresponds roughly to a 100 W(e) size. The RTG weight and performance results were obtained by performing a parametric study of an RTG model. The model includes significant conceptual detail for spacecraft integration purposes, but it does not provide an RTG design. (auth)

11413 (TID/SNG-7) RTG PARAMETRIC STUDY. Report for the RTG Study, Voyager Task C. Freedman, S.; Friedman, J.; Schmieder, J. (General Electric Co., Philadelphia, Pa. (USA). Missile and Space Div.). 29 Sep 1966. 37p. Dep. NTIS $5.00.

For Jet Propulsion Lab., Pasadena, CA. Declassified 21 Jun 1972.

Parametric sizing results for finned cylinder radioisotope generators (RTG's) for use in the Voyager spacecraft bus are presented. These results indicate trends of weight and performance characteristics rather than precise numerical results. The study indicates the lowest total weights for an assumed load of 600W will be from 200 to 300 lbs. (LCL)

11414 (TID/SNG-11) BASELINE CONFIGURATION SELECTION, VOYAGER TASK C. Concannon, M.; Mirabal, J.; Welch, J. (General Electric Co., Philadelphia, Pa. (USA). Missile and Space Div.). 15 Dec 1966. 25p. Dep. NTIS $4.25.

For Jet Propulsion Lab., Pasadena, CA.

A basic spacecraft configuration which can accommodate either solar cells or RTG's is presented, and possible design evolutions are discussed. (LCL)

11415 (TID/SNG-13) SPACECRAFT RADIATION MAPPING, VOYAGER TASK C. Peden, J. C.; Bermanis, H. L. (General Electric Co., Philadelphia, Pa. (USA). Missile and Space Div.). 15 Dec 1966. 23p. Dep. NTIS $4.25.

For Jet Propulsion Lab., Pasadena, CA.

An estimate is provided of the radiation fields that exist in and around the Voyager spacecraft as the result of using ^{238}Pu-fueled RTG's as the primary electrical power sources. (LCL)

11416 (TID/SNG-14) SUPPLEMENT TO VOYAGER RTG SPACECRAFT DESIGN DEFINITION, VOYAGER TASK C. (General Electric Co., Philadelphia, Pa. (USA). Missile and Space Div.). 1 May 1967. 50p. Dep. NTIS $5.50.

For Jet Propulsion Lab., Pasadena, CA.

A solar powered version of the Voyager spacecraft design is considered. The purpose of this consideration is twofold. First, the solar powered version serves as the model against which the RTG spacecraft will be compared on an overall basis. Second, it serves as the basis for determining the degree to which the design is convertible from a solar powered to an RTG-powered spacecraft. (auth)

11417 (TID/SNG-15) RTG SPACECRAFT MISSION ABORT STUDY, VOYAGER TASK C. Sergay, D.; Montgomery, D.; Bermanis, H. (General Electric Co., Philadelphia, Pa. (USA). Missile and Space Div.). 15 May 1967. 18p. Dep. NTIS $4.00.

For Jet Propulsion Lab., Pasadena, CA.

In order to assure that the general population will not be exposed to undue radiological hazards as the result of using RTG's for the Voyager spacecraft power supplies a study was made to examine the abort environments of the Voyager mission, review appropriate RTG fuel containment concepts, and examine the effect of fuel containment concepts on the spacecraft design. The general conclusions of this study were: separable reentry RTG's are applicable to a limited class of abort situations; the use of separable reentry RTG's would involve extensive design complexity in the spacecraft, shroud, and booster systems; integral reentry RTG's are applicable to a broad class of abort situations; and weight estimates of integral and separable reentry RTG's are comparable. (LCL)

11418 (TID/SNG-16) COMPARISON STUDY OF RTG AND SOLAR POWERED VOYAGER SPACECRAFT, VOYAGER TASK C. (General Electric Co., Philadelphia, Pa. (USA). Missile and Space Div.). 1 Jun 1967. 57p. Dep. NTIS $6.00.

For Jet Propulsion Lab., Pasadena, CA.

The relative merits of solar- and RTG-powered Voyager spacecraft are compared on the basis of weight, power, reliability, and mission flexibility. The results showed that RTG's have the following advantages over solar power: they have higher overall reliability because of constant operating conditions throughout life; removal of high duty-cycle batteries; they provide greater mission flexibility because of independence of solar energy; and they permit improved ground test verification. RTG's have the following disadvantages with respect to solar power: they are heavier—an improvement of about 20 to 25% in specific power (watts per pound) is needed to make them comparable with solar power for Mars missions; development is required relative to isotope fuel containment reentry protection; certain radiation detection instruments are incompatible with the RTG radiation environment; and additional shroud cooling is required during prelaunch operation. (LCL)

11419 SNAP-27 MISSION ASSESSMENT. Briley, J. R. (Johnson Space Center, Houston, TX). Trans. Am. Nucl. Soc.; 21: 2(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11420 APPLICATION OF THE TRANSIT RTG TO AN ADVANCED NAVY NAVIGATIONAL SATELLITE. Bradshaw, G. (General Atomic, Sandiego, CA); Dassoulas, J. Trans. Am. Nucl. Soc.; 21: 2-3(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11421 JUPITER AND BEYOND: PIONEER AND THE SNAP 19 RTG. Wilbur, A. C. (Ames Research Center, Moffett Field, CA); Russo, F. A. Trans. Am. Nucl. Soc.; 21: 3-4(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11422 SNAP 19 RTG INTEGRATION WITH THE VIKING LANDER. Brittain, W. M. (Teledyne Isotopes, Timonium, MD); Russell, R. A. Trans. Am. Nucl. Soc.; 21: 4(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11423 APPLICATIONS OF MHW RTGs FOR COMMUNICATION SATELLITES. Lombardo, J. J. (Energy Research and Development Administration, Washington, DC); Katucki, R. J. Trans. Am. Nucl. Soc.; 21: 4-5(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11424 NAVY HALF-WATT RTG: A SUPER-BATTERY BECOMES REALITY. Rosell, F. E. Jr. (Naval Nuclear Power Unit, Fort Belvoir, VA). Trans. Am. Nucl. Soc.; 21: 6(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11425 HALF-WATT BISMUTH–TELLURIDE RTG. Raag, V. (Syncal Corp., Sunnyvale, CA). Trans. Am. Nucl. Soc.; 21: 6-7(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11426 TELEDYNE ISOTOPES' DESIGN FOR A 15-YEAR HALF-WATT SUBSEA RPG. Hannah, R. G. (Teledyne Isotopes, Timonium, MD). Trans. Am. Nucl. Soc.; 21: 7(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

Facilities and Equipment

Refer also to abstract 13209.

11427 (AECL-4764) NEW TECHNIQUE FOR MEASURING THE EFFICIENCY OF PARTICLE SAMPLING PROBES IN FLOWING LIQUID SYSTEMS. Minns, D. E.; Ghai, R. K.; Johnson, D. R.; Ketcheson, F. H. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Dec 1974. 21p. Dep. NTIS (US Sales Only) $4.25. AECL $1.00.
A new and improved technique for determining sampling efficiencies of solid particles is described. This technique is a considerable improvement since it can measure sampling efficiencies accurately (±5%) for any concentration down to a single particle. The technique is based on detection of a single radioactive particle as it circulates in a test loop. For each cycle, the particle has the choice of moving into a sample line through the sample probe or continuing in the main stream. Each choice is recorded for many cycles and treated statistically to derive the efficiency of the probe. (auth)

11428 (CONF-750617-9) ROOM TEMPERATURE ELASTIC–PLASTIC RESPONSE OF THIN-WALLED TUBES SUBJECTED TO NONRADIAL COMBINATIONS OF AXIAL AND TORSIONAL LOADINGS. Liu, K. C. (Oak Ridge National Lab., Tenn. (USA)). 1975. 21p. Dep. NTIS $4.25.
From 2nd ASME national congress on pressure vessels and piping; San Francisco, California, USA (24 Jun 1975).
Two tubular specimens of type 304 stainless steel with uniform thin walls were subjected to a program of segmental combined tension/compression and torsion loadings at room temperature. A proportional, or radial, loading into the plastic range was initially applied to each specimen. Two nonproportional (nonradial) loadings along straight line segments for which neither the loading paths nor their linear extrapolations passed through the origin of the stress space were then applied. The axial and torsional stress-strain curves for these segmental prestress loadings were plotted. Hence, the stress-strain response characteristics for nonproportional loadings as well as for proportional loading can be studied. In addition, the axial and torsional plastic strain components were calculated, and the total plastic strain trajectories were plotted in a plastic strain space. Finally, using results from a detailed study of yield surfaces, which was performed for the first specimen, a spectrum of initial and subsequent yield curves corresponding to the segmental prestress loadings is presented. (auth)

11429 (NP-20459) STRESS ANALYSIS OF A CYLINDRICAL SHELL (AXIS HORIZONTAL) SUBMERGED IN WATER AND LOADED FOR NEUTRAL BUOYANCY. Osgood, E. C. (Massachusetts Univ., Amherst (USA)). Sep 1973. 26p. NSF/RANN.
A stress analysis of a cylindrical shell submerged in water and loaded for neutral buoyancy is presented. From this analysis it is concluded that reinforced concrete shells are structurally practical provided the proper shapes are chosen. The sphere is a particularly practical shape. For reactor enclosures a minimum wall thickness of 4 or 5 ft, is desirable to prevent radiation. Such a structure with a minimum of steel reinforcement is adequate for stress. In relatively short cylinders, longitudinal stress reinforcing would be required to relieve ring stresses, and other shell shapes, such as an oblate spheroid might be more practical. The problem of overcoming the natural buoyancy of a submerged shell is discussed, and it is concluded that the best way to achieve neutral buoyancy is to decrease the free space allowed for equipment and operation. (LCL)

11430 (ORNL-5020) THEORETICAL AND EXPERIMENTAL STRESS ANALYSES OF ORNL THIN-SHELL CYLINDER-TO-CYLINDER MODEL 3. Gwaltney, R. C.; Bolt, S. E.; Corum, J. M.; Bryson, J. W. (Oak Ridge National Lab., Tenn. (USA)). Jun 1975. Contract W-7405-eng-26. 179p. Dep. NTIS $7.60.
The third in a series of four thin-shell cylinder-to-cylinder models was tested, and the experimentally determined elastic stress distributions were compared with theoretical predictions obtained from a thin-shell finite-element analysis. The models are idealized thin-shell structures consisting of two circular cylindrical shells that intersect at right angles. There are no transitions, reinforcements, or fillets in the junction region. This series of model tests serves two basic purposes: the experimental data provide design information directly applicable to nozzles in cylindrical vessels; and the idealized models provide test results for use in developing and evaluating theoretical analyses applicable to nozzles in cylindrical vessels and to thin piping tees. The cylinder of model 3 had a 10 in. OD and the nozzle had a 1.29 in. OD, giving a d_0/D_0 ratio of 0.129. The OD/thickness ratios for the cylinder and the nozzle were 50 and 7.68 respectively. Thirteen separate loading cases were analyzed. In each, one end of the cylinder was rigidly held. In addition to an internal pressure loading, three mutually perpendicular force components and three mutually perpendicular moment components were individually applied at the free end of the cylinder and at the end of the nozzle. The experimental stress distributions for all the loadings were obtained using 158 three-gage strain rosettes located on the inner and outer surfaces. The loading cases were also analyzed theoretically using a finite-element shell analysis developed at the University of California, Berkeley. The analysis used flat-plate elements and considered five degrees of freedom per node in the final assembled equations. The comparisons between theory and experiment show reasonably good agreement for this model. (auth)

11431 EFFECT OF DEFECTS ON STRUCTURAL FAILURE: A TWO-CRITERIA APPROACH. Dowling, A. R.; Townley, C. H. A. (Central Electricity Generating Board, Berkeley, Eng.). Int. J. Pressure Vessels Piping.; 3: No. 2, 77-107(Apr 1975).
The two-criteria approach to the study of defects in structures assumes that failure occurs when the applied load reaches the lower of either a load to cause brittle failure in accordance with the theories of linear elastic fracture mechanics or a collapse load dependent on the ultimate stress of the material and the structural geometry. This simple approach is described and compared with previously published experimental results for various geometries and materials. The simplicity of this method of defect analysis lies in the fact that each criterion is sufficiently well understood to permit scaling and geometry changes to be accommodated readily. It becomes apparent that a sizeable transition region exists between the two criteria but this can be described in an expression relating the criteria. This expression adequately predicts the behavior of cracked structures of both simple and complex geometry. A design curve for defect assessment is proposed for which it is unnecessary to consider the transition region. (auth)

11432 PLASTICITY APPLIED TO CONSTRUCTIONS. Save, M. (Faculte Polytechnique de Mons (Belgium)). Ann. Mines; No. 2, 109-120(Feb 1975). (In French).
The theory of maximum load in perfectly plastic structures is described briefly, firstly in the case of beam systems, then of plates and shells. Attention is drawn to the importance of a correct experimental verification. The case of pressure vessels is briefly stated. (FR)

11433 FILM CASSETTE FOR RADIOGRAPHIC APPARATUS. Tomita, C.; Shimizu, K.; Ishizuka, T. (to Hitachi Medical Corp.). US Patent 3,884,818. 20 May 1975. Filed date 17 Sep 1973. 12p.
A film cassette for radiographic apparatus is described comprising an upper lid, a lower lid, a packing fixed to one surface of said lower lid at marginal portions thereof, a space defined by one surface of each of said lids and by the proximal peripheral surface of said packing for containing therein a film and intensifying

screens, and a valve means provided on the lower lid for rendering said space communicative with external atmosphere and for sealing said space from external atmosphere. Such a cassette ensures tight adherency between the film and the intensifying screens uniformly throughout the entire portions of them as said space is rendered substantially vacuous by discharging air from said space through said valve means. Thus, the cassette can be provided in a very thin structure, thereby enabling a number of cassettes to be set in a small size chamber in the radiographic apparatus. Moreover, such a cassette provides a greatly enhanced convenience in its handling, and reduces its manufacturing cost remarkably. (Official Gazette)

11434 INTERPRETATION OF DIFFUSION BATTERY DATA. Mercer, T. T.; Greene, T. D. (Univ. of Rochester, NY). Aerosol Sci.; 5: 251-255(1974).

The graphical method by which the parameters of a lognormal distribution are estimated from experimental data on the penetration of aerosols through a diffusion battery has been simplified by consolidating the numerous families of theoretical penetration curves into a single family showing penetration as a function of median diffusion parameter for several values of standard deviation. Curves and tables of data are given for batteries having ducts of either rectangular or circular cross-section. Empirical relationships between particle diameter and diffusivity, with which observed distribution statistics can be converted to statistics for lognormal particle size distributions, are provided. (auth)

11435 CONSIDERATIONS IN THE DESIGN OF A PLUTONIUM DIOXIDE FACILITY. Booth, R. L. (Nuclear Fuel Services, Inc., Rockville, MD). Trans. Am. Nucl. Soc.; 21: 247-248(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11436 CHARACTERISTICS OF RADIATION REFLECTED BY LEAD SCREENS IN BETATRON FLAW DETECTION. Golikov, E. G.; Zol'nikov, P. P.; Sukhanova, K. A. (Ural Polytechnic Inst., Sverdlovsk, USSR). Sov. J. Nondestruct. Test. (Engl. Transl.); 10: No. 2, 204-206(1974).

Translated from Defektoskopiya; 10: No. 2, 97-100(1974).

The energy characteristics of γ-irradiation reflected by lead screens, which are widely used in radiographic flaw detection of materials and components using a betatron as a source of primary radiation, are investigated experimentally. (auth)

11437 ELECTROTHERMAL REGULATING VALVE FOR FLUIDS. (to Stichting Reactor Centrum Nederland). Netherlands Patent 7,117,036/A/. 13 Dec 1971. 10p. (In Dutch).

The invention aims at an electrothermal mobile regulating valve for fluid flow. This control mechanism contains a part of the valve which is heated electrically and is therefore expanding. Another part of the valve is almost not expanding. Between both parts mentioned is an adjustable opening, which operates depending on the heating, for the measurement of fluid flow. (NL)

11438 REGULATOR VALVE. (to Nijverheidsorganisatie TNO). Netherlands Patent 7,113,753/A/. 7 Oct 1971. 9p. (In Dutch).

The invention provides a regulation valve particularly suited to liquid sodium. In this valve the hydrostatic bearing is fed with the differences in pressure present in the system instead of the usual overpressure of the circuit. In this way a leak current from the circuit to the outside is avoided. (NL)

11439 DETERMINING THE HEAT TRANSFER ON TUBE BUNDLE SUPPORT PLATES. Dagsoz, A. K. (Technological Univ., Istanbul). Sulzer Tech. Rev.; 56: No. 4, 263-266(1974).

Helical steam generators consist principally of spirally coiled tubes joined by support plates. The cylindrical tube bundles of different diameters are nested inside each other and held by the support plates. For stress analysis of the support plates, the heat transfer coefficient between gas and plate must be known. Model tests have been carried out in order to determine the coefficient between the support plate and the medium. The article concludes with suggestions for estimating the heat transfer coefficient between gas and plate. (auth)

11440 EVALUATION OF CYCLONE ASSEMBLY FOR FIELD USE IN THE MEASUREMENT OF AEROSOL PARAMETER, AMAD. Menon, V. B.; Sundarajan, A. R.; Joshi, P. P.; Kotrappa, P. (Bhabha Atomic Research Centre, Bombay). Health Phys.; 28: No. 5, 618-620(May 1975).

A knowledge of the aerosol parameter AMAD (activity median aerodynamic diameter) is necessary for the prediction of the fractional depositions of inhaled aerosols in various regions of the respiratory tract. The estimation of this parameter by a new method using the data obtained by a two-stage cyclone assembly is described and compared to the cascade impactor, centripeter and aerosol spectrometer methods. Comparisons of AMAD values obtained by cyclone and centripeter in a plutonium laboratory, in a reactor rod cutting building and with flurorescein aerosols are tabulated and show good agreement. It is concluded that the cyclone method gives sufficiently accurate values of AMAD in the range of 1 and 10 μm, which is the range normally encountered in radioactive or polluted atmospheres. The sampling and analysis are simple and the data provide AMAD, the gross concentration and the respirable fraction. (UK)

Lasers

Refer also to abstracts 11341 and 11342.

11441 (AD/A-001971) OPTICS RESEARCH: 1974:1. Semiannual Report, 1 January-30 June 1974. Rediker, R. H. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 30 Jun 1974. 53p. (ESD-TR-74-235). NTIS $4.25.

Topics discussed include: laser technology and propagation-pulse propagation, effects, and devices; optical measurements and instrumentation-interferometric image evaluation, and long-path monitoring of atmospheric carbon monoxide by a tunable diode laser system. (GRA)

11442 (AD/A-002450) OFF-AXIS RESONATORS. Final Technical Report. Phillips, E. A.; Reilly, J. P.; Northam, D. B. (Avco-Everett Research Lab., Everett, Mass. (USA)). Nov 1974. Contract N00014-74-C-0440. 45p. NTIS $3.75.

An experimental investigation of a novel unstable resonator configuration is reported. The purpose of the novel configuration is to change the distribution of the uniform-flux area of a standard unstable resonator (an annular beam with a hole in the center) into a configuration such that a maximum amount of the uniform-flux area is contiguous (i.e., provide a much larger region of constant flux). This is accomplished by the present off-axis unstable resonator. The present experimental results indicate no substantial loss of device output power or loss of far-field beam quality by the resonator configuration tested. Additional experimental results are presented indicating the sensitivity of resonator performance due to misalignment of the off-axis resonator. (GRA)

11443 (AD/A-003409) RESEARCH STUDIES ON TUNABLE OPTICAL PARAMETRIC OSCILLATORS. Final Report, 1 October 1972-30 September 1974. Harris, S. E. (Stanford Univ., Calif. (USA). Microwave Lab.). Oct 1974. Contract F19628-73-C-0025. 14p. (ML-2351; AFCRL-TR-74-0552). NTIS $3.25.

Abstracts on research studies concerning tunable optical sources and coherent sources in new spectral regions are presented. During this contract period work has been active on the general areas of tunable parametric processes, in techniques for generation of ultraviolet and vacuum ultraviolet radiation, in studies of techniques for up-converting infrared radiation, and in theoretical and experimental studies of excimer laser systems. (GRA)

11444 (ADB-002506) 1973 ANNUAL REPORT. (Defence Research Establishment Valcartier, Courcelette, Quebec (Canada)). 1973. 45p. (PD-18133). Dep. NTIS (US Sales Only) $5.25.

A separate abstract was prepared for the research report on lasers. Other research on surveillance, armaments, explosives and propellants, systems research and analysis, and facilities and new techniques not in scope for NSA is also described. (MCW)

For an abstract of an individual section see: 11445.

11445 (ADB-002506, pp 8-12) LASERS. 1973.

In 1973 annual report. (Defence Research Establishment Valcartier, Courcelette, Quebec (Canada)).

Laser-matter interaction at 10.6 μm was studied and development of high-energy TEA-CO_2 lasers continued. Methods of eliminating parasitic oscillations in amplifier chains were investigated. Significant work with various types of chemical lasers was performed, and efforts are continuing to extend their wavelength of operation from 1.3 to 10.6 μm. (auth)

11446 (LA-UR-75-711) SAFETY CONSIDERATIONS IN THE LASER RESEARCH PROGRAM AT THE LOS ALAMOS SCIENTIFIC LABORATORY. Winburn, D. C. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-eng-36. 42p. (CONF-750460-3). Dep. NTIS $5.25.

From 3rd conference on the laser; New York, New York, USA (22 Apr 1975).

Procedures used at the Los Alamos Scientific Laboratory to comply with the "American National Standard for the Safe Use of Lasers, ANSI Z136.1-1973" are described. (TFD)

11447 LASERS. Hasson, V. Certif. Eng.; 47: No. 4, 367-379(Apr 1974).

The paper reviews fundamental concepts of the interaction of radiation and matter, and differentiates between conventional and laser light sources. It summarizes the properties and establishes application of the most important commercial laser systems and discusses some recent significant developments in laser technology. (Elect. Electron. Abstr.)

11448 NATURAL AMPLITUDE FLUCTUATIONS IN THE DISTRIBUTED MODEL OF A TRAVELING-WAVE LASER. Virnik, Ya. Z. Radio Eng. Electron. Phys. (USSR) (Engl. Transl.); 19: No. 4, 90-95(Apr 1974).

Translated from Radiotekh. Elektron.; 19: No. 4, 775-781(Apr 1974).

The natural amplitude fluctuations in a single-mode distributed model of a traveling-wave laser with lumped losses are examined. A formula is obtained for the spectral density of the amplitude fluctuations, and it is analyzed in different frequency regions for the parameters of solid-state and gas lasers. The behavior characteristics of the spectral density are discussed for a long cavity. A comparison is made with the case of distributed losses. (auth)

11449 STABILIZED THERMALLY COMPENSATED MIRROR. Dunn, C. III; Tobin, R. D.; Bergstreser, N. E.; Heinz, T. A. (to Rockwell International Corp.). US Patent 3,884,558. 20 May 1975. Filed date 3 Jul 1972. 6p.

A thermally compensated mirror is described that is formed by a laminated structure. The structure is comprised of a front plate having a reflective front surface and having a plurality of grooves formed in the rear surface for conducting coolant fluid in heat exchanging relation with said reflective surface, a rear plate having coolant inlet and coolant outlet openings extending therethrough, a minimum temperature plate interposed between said front and rear plates and formed with a plurality of coolant distribution passageways coupled to receive coolant fluid from said coolant inlet and oriented to distribute said coolant fluid in a manner to establish a minimum temperature plane parallel to said reflective surface, a temperature stabilization plate interposed between said front plate and said minimum temperature plate and formed with a plurality of coolant distribution channels coupled to receive said coolant fluid after said coolant fluid has passed in heat exchanging relation with said reflective surface and oriented to distribute said coolant fluid in a manner to establish a uniform temperature plane parallel to said reflective surface, and means for circulating said coolant fluid through said structure in a predetermined path. (Official Gazette)

11450 APPARATUS FOR UNIFORM PUMPING OF LASING MEDIA. Condit, W. C.; Eccles, S. F. (to United States Energy Research and Development Administration). US Patent 3,883,819. 13 May 1975. Filed date 23 May 1974. 6p.

Electron beam pumping of gaseous or liquid lasing media is carried out by means of electron pulses generated by an electron accelerator. Between the accelerator and the laser cavity, the electron pulse is subjected to a magnetic field to turn the electron pulse approximately through a quarter orbit, so that in essence the direction of pulse travel is changed from axial to lateral. This procedure then enables pumping of the laser cavity uniformly and simultaneously, or in any desired traveling wave mode, over the entire length of the laser cavity with relatively short, and highly intense, electron pulses. (10 claims, 1 drawing figure) (Official Gazette)

11451 GAS LASER HAVING IMPROVED MULTIPLE-PART RESONATOR ADJUSTMENT. Burns, E. S.; Heising, S. J. (to Coherent Radiation). US Patent 3,883,820. 13 May 1975. Filed date 27 Apr 1973. 6p.

A gaseous laser having internal optical resonator mirrors and provided with a multiple-part resonator mirror adjustment is described. (Official Gazette)

11452 METAL-VAPOR LASER WITH IMPROVED VAPOR CONDENSING MEANS. Heising, S. J.; Dowley, M. W.; Shull, W. A. (to Coherent Radiation). US Patent 3,833,818. 13 May 1975. Filed date 27 Apr 1973. 6p.

A metal-vapor laser including means for reversing the direction of the electrical discharge as it leaves the discharge-confining bore tube to separate the transported vaporized metal from the active discharge region prior to condensation is described. (Official Gazette)

11453 X RAY LASERS. Bushuev, V. A.; Kuz'min, R. N. Usp. Fiz. Nauk; 114: No. 4, 677-686(Dec 1974). (In Russian).

The possibility of creating x-ray lasers is discussed and reviewed. Attempts have been made to stimulate the emission of x rays by irradiating various materials with high-energy electrons or x rays. The process of expanding a plasma into a neutral gas can be used to create a powerful, point, nonlaser source of x rays. The creation of gamma lasers is also reviewed. The problems of creating x ray lasers are complex, and require the cooperation of many disciplines. (SJR)

11454 WAVEGUIDE HELIUM-NEON LASER. Gonchukov, S. A.; Kornilov, S. T.; Petrovskii, V. N.; Protsenko, E. D.; Rubezhnyii, Yu. G. (Moscow Engineering and Physics Inst.). Kvsntovaya Elektron. (Moscow); 2: No. 2, 406-408(Feb 1975). (In Russian).

Results of an investigation of the properties of radiation from a waveguide He-Ne laser at a wavelength of 3.39 micrometers are shown. The results are cited from measuring the behavior of the output power as a function of the geometry of the resonator, pressure and composition of the mixture of gases. The results are also given from an investigation on the spectral composition of the radiation. An unsaturated amplification of 170 db/m was produced for one operation in a discharge tube of a laser with a waveguide channel dia of 510 micrometers. (JPRS)

11455 INVESTIGATION OF THE OPERATION OF A RING-SHAPED LASER WITH A METHANE ELEMENT. Andronova, I. A.; Bershteyn, I. L.; Markelov, N. A. Kvantovaya Elektron. (Moscow); 2: No. 2, 294-302(Feb 1975). (In Russian).

An investigation was made of the operation of a ring-shaped laser with a methane element operating at the 3.39 micrometer wavelength in a mode of splitting the counter waves at the power peak. A method is described for producing a smooth shape for the peak and the tie-in of the half-sum of the wave frequencies to the mean frequency of the methane absorption line. The effect of frequency self-stabilization was determined. The results of the investigation are shown graphically. (JPRS)

11456 POSSIBILITY OF CREATING OF CF_3I LASER IN A GLOW DISCHARGE. Zalesskii, V. Yu.; Ivanov, M. G. Kvantovaya Elektron. (Moscow); 2: No. 2, 277-280(Feb 1975). (In Russian).

The possibility of producing laser radiation in CF_3I molecules by their dissociation was examined. Population inversion conditions are found for the working levels of iodine atoms. It was found that unlike the photodissociation laser operating on CF_3I and other similar molecules, a laser of the type described could theoretically operate at near atmospheric pressure. (JPRS)

11457 RING-SHAPED HELIUM-NEON LASER WITH A NEON ABSORBING ELEMENT. Danileyko, M. V.; Kozubovskii, V. R.; Nedavnii, A. P.; Shpak, M. T. (Inst. of Physics, Kiev). Kvantovaya Elecktron. (Moscow); 2: No. 2, 400-402(Feb 1975). (In Russian).

Discussions are given on observing the absorption resonance of neon in a ring-shaped He–Ne laser operating at a wavelength of 3.39 micrometers. The width of the resonance is less than the radiation width of the line with a contrast up to 20%. It is suggested that the absorption resonances of the ring-shaped gas laser be used for superhigh-resolution spectroscopy. It was shown that the observed resonance can be used for this purpose by measuring the shift of the ^{22}Ne line with pressure. (JPRS)

11458 INVESTIGATION OF DISTORTIONS OF THE RADIATION PATTERN OF LASER RADIATION BY MIRRORS AND TRANSPARENT DIELECTRICS. Karlov, N. V.; Krynetskii, B. B.; Mishin, V. A.; Moshkunov, A. I. Radio Eng. Electron. Phys. (USSR) (Engl. Transl.); 19: No. 5, 30-33(May 1974).

Translated from Radiotekh. Elektron.; 19: No. 5, 964-969(May 1974).

A description is given of a setup for the direct observation of the widening of the angular radiation pattern after passing through transparent media and after reflection from mirrors. The setup uses an autocollimation system. Results of measurements of the widening of the radiation pattern of laser radiation by various optical components are given. It is shown that small variations in the refractive index of transparent optical components can considerably distort the radiation pattern of laser radiation. (auth)

11459 EFFECT OF RANDOM PERTURBATIONS ON THE ENERGY CHARACTERISTICS OF A LASER. Nedranets, Yu. I.; Berezin, V. I. (Saratov State Univ., USSR). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 1, 124-125(1975). (In Russian).

The stability of the energy characteristics of laser emission is determined mainly by the stability of pumping and resonator quality. This study considers the statistical characteristics of laser radiation on the assumption that the pumping power and resonator quality are random functions. The behavior of the system near steady state is investigated. Thus, it is shown that if the pumping power and resonator quality are random functions having approximately equal perturbation intensities, the main contribution to the dispersion of the laser emission is introduced by random pumping perturbations, and the dispersion practically does not depend on the level of pumping power. (SJR).

11460 EFFECT OF SELF-INDUCED STANDING WAVES IN LASERS ON THE DENSITY OF THE EMERGING RADIATION. Kabaeu, M. I. (Inst. of Physics, Minsk). Vestsi Akad. Navuk BSSR, Ser. Fiz.-Mat. Navuk; No. 2, 72-76(1975). (In Russian).

The effect of self-induced standing waves in the active medium of a laser on the distribution of the radiation field and on the energy coming from the resonator was studied. It was shown that, by Bragg reflection from a periodic structure embedded in an an amplifying medium, there is a cut-off of the energy in the resonator. The density of the emerging radiation (for small fields) is less by a factor of 2 to 3 than shown by calculations without consideration of the standing waves. The latter circumstance must be considered in calculation of the optimum parameters of the resonator. (tr-auth)

11461 OUTPUT POWER STABILIZATION FOR A He–Ne LASER. Nowicki, R. (Politechniki, Wroclaw). Elektronika (Warsaw).; 16: No. 3, 132-134(1975). (In Polish).

A simple system for the output power stabilization of a He–Ne laser is described, which operates by controlling the intensity fluctuations through corrections applied to the discharge current. The working conditions of the laser necessary for a good stabilization are discussed. A stability of $\pm 2 \times 10^{-6}$ over periods of 10 minutes and $\pm 4 \times 10^{-5}$ during 100 minutes has been achieved. (auth)

11462 MUTUAL LOCKING OF LASERS. Grigor'yants, V. V.; Suvorov, V. A. Radio Eng. Electron. Phys. (USSR) (Engl. Transl.); 19: No. 4, 81-89(Apr 1974).

Translated from Radiotekh. Elektron.; 19: No. 4, 765-774(Apr 1974).

The locking of lasers is considered as a process of generating electromagnetic oscillations in a system of two coupled lasers. Shortened equations of motion are obtained for lasers with homogeneously broadened spectral lines of the active media for generation near the centers of these lines. Using these equations, a formula is found for the oscillation frequency locking range, and the behavior of the generation frequency under locking conditions is examined. The characteristics of the oscillations in a laser, locked by an external signal, are investigated in the special case of coupling by means of an ideal gating device. A qualitative method is suggested for analyzing the oscillation processes in lasers, based on an analogy with classical radio engineering, using the concepts of the oscillation characteristic and the feedback characteristic of lasers. (auth)

11463 LASER APPLICATIONS TO OPTICS AND SPECTROSCOPY. Jacobs, S.; Sargent, M. III; Scott, J. F.; Scully, M. O. Physics of Quantum Electronics. Volume 2. Reading, MA; Addison-Wesley Publishing Company, Inc. (1975). 520p. $23.50.

Separate abstracts were prepared for six of the twelve chapters. The remaining six chapters are not in scope for NSA. (TFD)

For abstracts of individual chapters see: 11464–11469.

11464 TUNABLE SEMICONDUCTOR DIODE LASERS AND APPLICATIONS. Melngailis, I.; Mooradian, A. (Massachusetts Inst. of Tech , Lexington). pp 1-51 of Laser Applications to Optics and Spectroscopy. Vol. 2. Jacobs, S. (ed.). Reading, MA; Addison-Wesley Publishing Co., Inc. (1975).

An experimental review of tunable diode lasers is presented. Stripe geometry and heterostructure devices are detailed with emphasis on output characteristics and applications. (TFD)

11465 DYE LASERS. Dienes, A. (Univ. of California, Davis). pp 53-121 of Laser Applications to Optics and Spectroscopy. Vol. 2. Jacobs, S. (ed.). Reading, MA; Addison-Wesley Publishing Co., Inc. (1975).

Principles of pulsed, modelocked and cw dye lasers are developed with particular attention to the nature of the active media and to spectroscopic applications. (TFD)

11466 SPIN-FLIP LIGHT SCATTERING AND SPIN-FLIP LASERS. Scott, J. F. (Univ. of Colorado, Boulder). pp 123-180 of Laser Applications to Optics and Spectroscopy. Vol. 2. Jacobs, S. (ed.). Reading, MA; Addison-Wesley Publishing Co., Inc. (1975).

A review of spin-flip scattering in semiconductors from both theoretical and experimental viewpoints is presented. Broadening mechanisms, selection rules, and applications are discussed. (TFD)

11467 GENERATION OF ULTRAVIOLET AND VACUUM ULTRAVIOLET RADIATION. Harris, S. E.; Young, J. F.; Kung, A. H.; Bloom, D. M.; Bjorklund, G. C. (Stanford Univ., CA). pp 181-197 of Laser Applications to Optics and Spectroscopy. Vol. 2. Jacobs, S. (ed.). Reading, MA; Addison-Wesley Publishing Co., Inc. (1975).

Nonlinear optical techniques that make use of phase-matched mixtures of metal vapors and inert gases, or in certain cases of only inert gases for generation of ultraviolet and vacuum ultraviolet radiation are described. (TFD)

11468 MODE-LOCKED LASERS AND ULTRASHORT LIGHT PULSES. von der Linde, D. (Bell Labs., Murray Hill, NJ). pp 351-366 of Laser Applications to Optics and Spectroscopy. Vol. 2. Jacobs, S. (ed.). Reading, MA; Addison-Wesley Publishing Co., Inc. (1975).

Some aspects of the generation of very short optical pulses using mode-locked lasers, with the emphasis on pulsed laser systems are reviewed. Active and passive mode-locking is discussed, and the problem of measuring ultrashort light pulses is considered. A survey of some commonly used sources and techniques for the generation of ultrashort light pulses follows. The paper concludes with a short account of limitations in the generation and propagation of these pulses. (auth)

11469 STABILIZED LASERS AND APPLICATIONS. Evenson, K. M.; Petersen, F. R. (National Bureau of Standards, Boulder, CO). pp 367-436 of Laser Applications to Optics and Spectroscopy. Vol. 2. Jacobs, S. (ed.). Reading, MA; Addison-Wesley Publishing Co., Inc. (1975).

Stabilization of lasers by saturated absorption is discussed with applications to measurements of fundamental constants (e.g., speed of light), length standards, ultrahigh resolution spectroscopy, and seismography. (TFD)

Cryogenic and Superconducting Equipment and Devices

11470 SUPERCONDUCTIVITY APPLICATIONS. Superconducting Magnets in Physics: Problems and Prospects. Bronca, G.; Parain, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91–Gif-sur-Yvette (France). Service d'Entretien et de Developpement des Appareils de Physique). Rev. Gen. Electr.; 83: No. 10, 697-702(Oct 1974). (In French).

From one-day meeting of the "Societe des Electriciens, des Electroniciens et des Radioelectriciens"; Grenoble, France (17 May 1974).

Applications of superconductivity have been developed in the field of nuclear physics. The present status of solutions for the construction of magnets using superconducting winding is examined. A review is given of achievements and projects using superconductors for the production of magnetic fields. (FR)

11471 SUPERCONDUCTING ELECTRIC POWER TRANSMISSION. Rabinowitz, M. (Electric Power Research Inst., Palo Alto, CA). Trans. Am. Nucl. Soc.; 21: 141-142(Jun 1973).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

Heat Transfer and Fluid Flow

Refer also to abstracts 11439, 13070, 13183, 13207, 13225, 13226, 13254, 13436, 13613, 13614, 13616, 13617, 13634, and 13635.

11472 EFFECTS OF SPACER ON BURNOUT HEAT FLUX. Cho, Y. C. J. Korean Soc. Mech. Eng.; 13: No. 3, 209-218(1973).

Burnout experiments to study effects of spacers on burnout heat flux in rod bundles were carried out at a system pressure of 10 kg/cm^2, coolant mass velocity $2 \sim 10 \times 10^6$ kg/m^{2}h, and inlet subcooling $0 \sim 40$°C. The spacer investigated was a plate-type or a ring-type spacer. Test sections consisted of three rod bundles and a tube surrounding them. The outer dia and the heated length of the rod were 10 mm and 300 mm, respectively. Test results revealed that a spacer installed at the inlet of the heated section or 3/4 of the heated length from the inlet influences on the burnout heat flux of the heated section and in either case the burnout heat flux is greater than the one without spacer. (Korean Sci. Abstr.)

11473 VAPOUR VOID FRACTION IN SUBCOOLED FLOW BOILING. Maitra, D.; Subba Raju, K. (Indian Inst. of Tech., Madras). Nucl. Eng. Des.; 32: No. 1, 20-28(Apr 1975).

Experimental data on steam void fraction and axial temperature distribution in an annular boiling channel for low mass-flux forced and natural circulation flow of water with inlet subcooling have been obtained. The ranges of variables covered are: mass flux = 1.4×10^4 to 1.0×10^5 kg/h m^2; heat flux = 4.5×10^3 to 7.5×10^4 kcal/h m^2; and inlet subcooling = 10 to 70°C. The present and literature data match well with the theoretical void predictions using a four-step method similar to that suggested by Zuber and co-workers. (auth)

11474 CALCULATING THE MAXIMUM CRITICAL HEAT FLUX DURING NUCLEATE BOILING IN A LARGE VOLUME ON CYLINDRICAL AND SPHERICAL SURFACES. Borishanskii, V. M.; Fokin, B. S. Inzh.-Fiz. Zh.; 28: No. 2, 374-376(Feb 1975). (In Russian).

The effect of geometry and size of the heating surface on the critical heat flux was investigated by postulating a theoretical bubble size which is detached from the heated surface. The ratio of critical heat flux on a horizontal cylinder of radius R to the maximum heat flux on a surface of unlimited dimensions is directly proportional to the square of the ratio of the diameter of the bubbles detached from the two surfaces. The experimental data on the maximum critical heat fluxes are represented by two empirical expressions for horizontal and spherical surfaces. The deviation of calculated values from the empirical values does not exceed 10 to 15%. Thus these equations can be used in design calculations. (SJR)

11475 ANALYSIS OF FINITE DIFFERENCE SCHEMES FOR GENERAL CONVECTIVE AND CONDUCTIVE PROCESSES. Runchal, A. K. (Dames and Moore, London); Spalding, D. B. Trans. Am. Nucl. Soc., 21: 198(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11476 TWO-DIMENSIONAL FLUID TRANSIENTS BY THE METHOD OF CHARACTERISTICS. Shin, Y. W.; Daley, J. G. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 200-201(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11477 EFFECT OF PIPE PLASTICITY ON FLUID PRESSURE TRANSIENTS. Youngdahl, C. K.; Kot, C. A. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 201-202(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11478 MONTE CARLO SOLUTION TO TRANSIENT HEAT CONDUCTION PROBLEMS. Hoffman, T. J. (Univ. of Tennessee, Knoxville); Banks, N. E. Trans. Am. Nucl. Soc.; 21: 204-205 (Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11479 INVESTIGATION OF ADIABATIC OUTFLOW OF SATURATED AND SUBCOOLED WATER THROUGH CYLINDRICAL CANALS HAVING SHARP-EDGED INLETS. Aleshin, V. S.; Kalaida, Yu. A.; Fisenko, V. V. At. Energ. (USSR); 38: No. 6, 375-378(Jun 1975). (In Russian).

Results are reported of experimental investigations on the discharge of saturated and subcooled water through 5 and 9.53-mm dia cylindrical canals having sharp-edged inlets, a ratio of 1/d of 0.5 to 18.0 for a pressure variation before the outflow canal of 25 to 150 atm, and water subcooled below saturation from 0 to 100°C. Experimental data obtained provide information on the effect of various factors on the mass flow rate. Critical regimes of flow of boiling water in the canal were investigated. Pressure and temperature profiles in the test canals are given. Calculated dependence for estimating mass flow rates of water discharging from long and short tubes are given. (auth)

11480 BUBBLE INDUCED HEAT TRANSFER IN TWO PHASE GAS-LIQUID FLOW. Kubie, J. (Aston Univ., Birmingham, Eng.). Int. J. Heat Mass Transfer; 18: No. 4, 537-551(Apr 1975).

The influence of gas bubbles on heat transfer in two-phase gas liquid systems was investigated. Platinum wires were used as heat-transfer probes and the two-phase flow was simulated by generating a single continuous stream of discrete gas bubbles into a stationary liquid. The contribution of various modes of heat transfer was determined. It was found that transient conduction into the liquid is the predominant mode of the bubble-induced heat transfer and is responsible for about 75% of heat transfer: convection contributes the remainder. A theoretical model of the bubble induced heat transfer based on the surface renewal and penetration theory was developed. (auth)

11481 NATURAL CONVECTION WITH MERCURY IN A UNIFORMLY HEATED VERTICAL CHANNEL DURING UNSTABLE LAMINAR AND TRANSITIONAL FLOW. Humphreys, W. W.; Welty, J. R. (Oregon State Univ., Corvallis). AIChE (Am. Inst. Chem. Eng.) J.; 21: No. 2, 268-274(Mar 1975).

Experimental heat transfer correlations were determined for natural convection in mercury in a uniformly heated vertical channel with width-to-height ratios varying from 0.25 to infinity (the single plate limit). Local modified Grashof numbers varied between 10^8 and 10^{11}. Temperature and velocity profiles were obtained for these same channel configurations and local Grashof numbers. Instantaneous velocity plots indicate the range of conditions studied to proceed from unstable laminar flow well into the transition regime. Heat transfer results are in good agreement with earlier results reported for stable laminar flow which were limited to values of modified Grashof number less than 10^9. (auth)

11482 INCEPTION CRITERIA FOR DROPLET ENTRAINMENT IN TWO-PHASE CONCURRENT FILM FLOW. Ishii, M.; Grolmes, M. A. (Argonne National Lab., IL). AIChE (Am. Inst. Chem. Eng.) J.; 21: No. 2, 308-318(Mar 1975).

Inception criteria for droplet entrainment in concurrent gas-liquid film flow were developed from simple physical models. For film Reynolds number greater than or approximate to 160, an entrainment model based on the shearing off of roll-wave crests was used. At lower film Reynolds numbers, a wave undercutting mechanism was introduced. Experimentally observed abrupt changes in the critical gas velocity corresponding to the onset of entrainment at a certain film Reynolds number have been explained by the shift in the entrainment mechanisms. An agreement of the present inception criteria with various experimental data is shown to be satisfactory, and significant improvements over the existing empirical correlations have been made. (auth)

11483 GROWTH OF VAPOR BUBBLES IN SUPERHEATED SODIUM. Dalle Donne, M.; Ferranti, M. P. (Gesellschaft fuer Kernforschung mbH, Karlsruhe, Ger.). Int. J. Heat Mass Transfer; 18: No. 4, 477-493(Apr 1975).

It is known from experiments that the degree of incipient boiling superheat can be considerably higher with sodium than with water. The expanding bubble experiences large temperature differences. This together with the fact that thermal diffusivity of the liquid sodium is much higher than that of water, is the reason why the Plesset–Zwick asymptotic solution is valid for sodium only for very low superheats. In the present work a way to numerically integrate the relevant differential equations with the computer code HY-BUBBLE is shown. Results for sodium with superheats up to 380°C are given. Comparison of HY-BUBBLE calculations for water with relatively high degrees of superheat with experiments of Cole and Shulman and of Kosky [Int. J. Heat Mass Transfer, 9: 1377-90 (1966)] show good agreement. HY-BUBBLE calculations cannot predict the experiments of Hooper and Abdelmessih [Proc. Third Int. Heat Transfer Conf., ASME-AIChE Chicago (Aug 1966)] for water with high degrees of superheat. (auth)

11484 NUMERICAL CALCULATION OF MULTIPHASE FLUID FLOW. Harlow, F. H.; Amsden, A. A. (Los Alamos Scientific Lab., NM). J. Comput. Phys.; 17: No. 1, 19-52(Jan 1975).

A new computing technique is described for the solution of fluid flow problems in which several fields interpenetrate and interact with each other. An implicit coupling for each field between mass transport and equation of state allows for calculations in all flow-speed regimes, from far subsonic (incompressible) to far supersonic. In addition, the momentum transport between fields is implicit, allowing for all degrees of coupling, from very loose to completely tied together. Phase transitions permit interchange of mass, momentum and energy between fields, each of which is composed of several components. Considerable generality is present, to permit application to a wide scope of complicated problems, for example, the fluidized dust bed, the flow of a liquid with entrained bubbles, and atmospheric condensation with the fall of precipitation. (auth)

11485 CALCULATING THREE-DIMENSIONAL FLUID FLOWS AT ALL SPEEDS WITH AN EULERIAN-LANGRANGIAN COMPUTING MESH. Pracht, W. E. (Los Alamos Scientific Lab., NM). J. Comput. Phys.; 17: No. 2, 132-159 (Feb 1975).

A computing technique is presented for the calculation of three-dimensional, time-dependent fluid dynamics problems. The full nonlinear Navier–Stokes equations are solved with a finite difference scheme based upon an Arbitrary Lagrangian-Eulerian (ALE) computing mesh with vertices that may move with the fluid (Lagrangian), remain fixed (Eulerian), or move in any prescribed manner. The method is applicable to three-dimensional flows at all speed, employing an implicit formulation similar to the Implicit Continuous-Fluid Eulerian (ICE) technique. Marker particles are used that may follow exactly the motion of the fluid to aid in flow visualization, or they can represent particulate matter whose behavior is affected by inertia, drag, gravity, and molecular and turbulent diffusion. Calculational examples are shown in the form of a variety of perspective view plots. (auth)

Materials Testing

Refer also to abstracts 11433, 11641, 12095, 12100, and 12266.

11486 GENERAL DESCRIPTION OF PROTON SCATTERING RADIOGRAPHY. West, D. (UKAEA, Harwell, Eng.). Atom (London); No. 222, 54-59(Apr 1975).

A new method of radiography employing protons is described. It has the unique property of depending on scattering rather than absorption. The radiographs reveal an aspect of objects different from that shown by x-rays, neutrons or other methods using protons. The possible role of this type of radiography is examined. (auth)

11487 APPLICATION OF ACOUSTIC EMISSION TO THE STUDY OF STEEL FRACTURES. Mirabile, M. (Centro Sperimentale Metallurgico, Rome (Italy)). Mem. Sci. Rev. Metall.; 71: No. 9, 495-507(Sep 1974). (In French).

Acoustic emission testing is a relatively new nondestructive technique. Some theoretical models are presented enabling the origin of acoustic emission to be investigated. A relation is established between the experimental results obtained on low strength steels and the different types of fractures. (FR)

11488 DESCRIPTION OF AN OPTICAL HOLOGRAPHIC SYSTEM FOR 3-D RADIOGRAPHIC IMAGE DISPLAY. Ellingson, W. A. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 100-101(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11489 IMAGE RECONSTRUCTION WITH A SCANNING RADIATION GAUGE FOR NDT APPLICATIONS. Sweeney, D. W. (Purdue Univ., West Lafayette, IN). Trans. Am. Nucl. Soc.; 21: 101-103(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11490 EVALUATION OF RADIOGRAPHIC PAPER FOR THERMAL-NEUTRON RADIOGRAPHY. Berger, H. (National Bureau of Standards, Washington, DC). Trans. Am. Nucl. Soc.; 21: 148-149(Jun 1973).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11491 LOW-INTENSITY BEAMS FOR NEUTRON RADIOGRAPHY. Holland, L. (Birmingham Univ., Eng.). Trans. Am. Nucl. Soc.; 21: 149-150(Jun 1973).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11492 RADIOMETRIC GAMMA FLAW DETECTOR FOR THE INSPECTION OF CAST PIPES. Pokrovskii, A. V.; Malofeev, B. I. (Scientific-Research Inst. for Internal Flaw Detection, Tomsk, USSR). Sov. J. Nondestruct. Test. (Engl. Transl.); 10: No. 2, 183-186(1974).

Translated from Defektoskopiya; 10: No. 2, 74-78(1974).

The 3-channel model RDR-21 radiometric γ-flaw detector has been developed for testing steel pipes, and the design and the inspection geometry have been substantiated. The quipment used for compensating surface roughness is considered, and the methods and results of investigating the main metrological characteristics of the flaw detector are described. (auth)

11493 CHOICE OF SIGNAL/NOISE RATIO AND DIMENSIONS OF THE READING APERTURE IN RADIOGRAPHY. Troitskii, I. N. Sov. J. Nondestruct. Test. (Engl. Transl.); 10: No. 2, 191-197(1974).

Translated from Defektoskopiya; 10: No. 2, 82-89(1974).

The statistical character of radiographic images is analyzed. A method of estimating the necessary signal/noise ratio is described; on the basis of an analysis of the accuracy of the information so read, the condition for the optimum size of the aperture in the scanning device is formulated. (auth)

11494 TESTING TECHNIQUES BASED ON THE SPLIT HOPKINSON BAR. Albertini, C.; Montagnani, M. (EURATOM, Ispra, Italy). pp 22-32 of Mechanical Properties at High Rates of Strain. New York: American Inst. of Physics (1974).

From conference on mechanical properties of materials at high rates of strain; Oxford, UK (2 Apr 1974). See CONF-740413-.

To ascertain the effects of a nuclear reactor accident, three testing techniques were developed for determining the mechanical state equations of metallic materials in tension: (1) A system based on the explosion of a detonating explosive. The explosive, placed in two symmetric fire chambers, is ignited by an electric detonator. The pressure wave (of about 200 x 10^{-6} s duration) impinges, by a buffer, on the end of the bar. The tension wave transmitted along the bar provokes deformation and fracture of the specimen with a strain rate of about 10^3 s^{-1}. This system has been adopted because it was possible to synchronize the experiment with a fast camera, especially developed for explosives. Unfortunately, the method shows at the moment a rise time not shorter than 40 x 10^{-6} s. Because of lack of time, the testing method has not been further developed. (2) The second system is based on a prestressed loading bar. By the rupture of a brittle intermediate piece, a tension wave is transmitted along the bar. This method, easy to operate, allows a rise time shorter than 25 x 10^{-6} s and a pulse duration proportional to the bar length. It has been used up to now in a field of strain rates between 10^2 and 10^3 s^{-1}. (3) The third method is based on a shock tube used as a loading device. By this method, a long duration pulse may be generated. The system has been used between 1 and 10^2 s^{-1}. Results obtained in the strain rate range between 10^{-2} and 10^3 s^{-1} on AISI 304, 304L, 347 steels are presented and discussed. (auth)

11495 RADIOGRAPHY IN THE ACADEMIC CURRICULUM. Sharpe, R. S. (AERE, Harwell, Eng.). pp 127-146 of Radiation Engineering in the Academic Curriculum. Vienna; International Atomic Energy Agency (1975).

From proceedings of a study group on radiation engineering in the academic curriculum; Haifa, Israel (27 Aug 1973). See STI/PUB-372; CONF-730866-.

The interactions of wave and particulate forms of energy with materials provide the basis of a wide range of radiographic inspection techniques. Radiography as an area of study, however, has not received the academic attention and research support that it properly deserves. The paper presents some of the background achievement, present interests and future possibilities on which material for a balanced undergraduate and postgraduate course on radiography might be based. Some detailed proposals for course topics are presented in appendices. (auth)

11496 NONDESTRUCTIVE TESTING IN METALLURGY USING NUCLEAR TECHNIQUES. Kato, M. (Univ. of Tokyo). pp 209-224 of Radiation Engineering in the Academic Curriculum. Vienna; International Atomic Energy Agency (1975).

From proceedings of a study group on radiation engineering in the academic curriculum; Haifa, Israel (27 Aug 1973). See STI/PUB-372; CONF-730866-.

There are many demands for nondestructive testing in the metallurgical industry. The high temperature and corrosive characteristics of metallurgical processes lead to practical problems, which to some extent have been overcome by the use of nuclear techniques. The paper describes a number of different applications of nondestructive methods characteristic for the metallurgical industry. Both gauging and tracer methods are illustrated. (auth)

11497 NONDESTRUCTIVE DETERMINATION OF GLASS CONTENT AND OF VOIDS IN REINFORCED PLASTICS. Hoefer, G.; Gayer, P. (Farbenfabriken Bayer A. G., Leverkusen (F. R. Germany. Zentralbereich Zentrale Anwendungstechnik Materialpruefung). Materialpruefung; 17: No. 1, 19(Jan 1975). (In German).

A report is given on a method for the nondestructive determination of glass content and of voids in reinforced plastics from absorption measurements of high and low-energy gamma quanta. The resolution was found to be 2 cm^2. The accuracy of the glass content determination was ±0.015 which corresponds to a relative error of 10% with an average glass content of 15%. Resolution and accuracy could be increased by a greater expenditure. As the properties (μ,ρ) of the pure components (glass, resin) must be known and in a new measuring system the build-up factor determined, considerable pre-investigations are necessary in an individual case. It is only when series testing of the same type of parts is carried out that the time expenditure is reduced to a few minutes. Basically, the voids can also be quantitatively determined, however this value carries a large error (difference of two large numbers). The shape and arrangement of the voids can not be determined as the resolution is not sufficient. A transmission picture with soft X-rays tells more, even if it cannot give an absolute value. (auth)

Nuclear Explosions

11498 (ERDA-44) PEACEFUL NUCLEAR EXPLOSIONS. (Energy Research and Development Administration, Washington, D. C. (USA)). 1975. 40p. (CONF-750411-5). Dep. NTIS $4.00.

From European nuclear conference; Paris, France (21 Apr 1975).

An overview of world activities in the development of peaceful nuclear explosions is presented. (TFD)

11499 (NP-20451) NORSAR (NORWEGIAN SEISMIC ARRAY) REPORT FOR THE PERIOD 1 JULY 1972–30 JUNE 1974. Bungum, H. (ed.). (Norges Teknisk-Naturvitenskapelige Forsknings-

raad, Kjeller. NORSAR). Dec 1974. 40p. (In Norwegian). Dep. NTIS (US Sales Only) $5.00.

The purpose of the Norwegian Seismic Array (NORSAR) is to carry out research and experiments in fields connected to problems in distinguishing underground nuclear explosions from earthquakes by seismic methods. NORSAR is largely financed by the Advanced Research Agency, USA (ARPA) and is connected to the ARPANET computer network in the US by satellite. The general background for NORSAR's work is presented, followed by a description of the array of seismic stations around the lake Mjøsa, about 150 km N. of Oslo, their seismometers and the data center at Kjeller, near Oslo. A brief description of ARPANET is given. A general description is then given of the research program at NORSAR and of the international cooperation in the field. The Nuclear Test Ban Treaty of 1974 is finally briefly presented and discussed. A publications list is given. (NO)

11500 (UCRL-51795) GAS PRESSURE FROM A NUCLEAR EXPLOSION IN OIL SHALE. Taylor, R. W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 9 Apr 1975. Contract W-7405-eng-48. 27p. Dep. NTIS $4.00.

The quantity of gas and the gas pressure resulting from a nuclear explosion in oil shale is estimated. These estimates are based on the thermal history of the rock during and after the explosion and the amount of gas that oil shale releases when heated. It is estimated that for oil shale containing less than a few percent of kerogen the gas pressure will be lower than the hydrostatic pressure. A field program to determine the effects of nuclear explosions in rocks that simulate the unique features of oil shale is recommended. (auth)

11501 RELATION OF GEOLOGICAL STRUCTURE TO SEISMICITY AT PAHUTE MESA, NEVADA TEST SITE. McKeown, F. A. (Geological Survey, Denver). Bull. Seismol Soc. Am.; 65: No. 3, 747-764(Jun 1975).

Some of the abundant and unique geological and seismological data acquired at the Nevada Test Site is integrated with the objectives of (1) resolving some of the ambiguity in explanations of the source of aftershocks of nuclear explosions, and (2) demonstrating the value of using detailed geological and seismological data to infer realistic source parameters of earthquakes. The distribution of epicenters of aftershocks from nuclear explosions at Pahute Mesa suggests that they are related to faults or intersections of faults in the buried ring-fracture zones of calderas rather than to the conspicuous basin-and-range faults exposed at the surface. Histograms of fault length show clearly that faults in a basin-and-range regime differ significantly in length, median length, and distribution of length from faults in a caldera regime. A histogram of fault lengths derived from magnitudes of aftershocks shows both the median and distribution characteristics of caldera faults rather than of basin-and-range faults. Cumulative frequency-fault length-squared plots also show differences in the two fault regimes, and have slopes, herein called bf slopes, of -0.89 for caldera and basin-and-range faults, respectively. The bf slopes are similar to the average slope of a cumulative frequency-strain plot for aftershocks rather than to the b slopes for cumulative frequency-magnitude plots. Although the significance of b and bf slopes and differences between them are not resolved clearly, it is concluded that the fault length and strain data reflect dimensions of seismic sources rather than energy of seismic events. The principal conclusion of the investigation is that the most obvious geology of a seismically active area may not provide the proper basis for inferring seismic-source parameters. (auth)

11502 SEISMOLOGY HELPS TO MEASURE THE YIELD. Varghese, T. G.; Vijaikumar. (Bhabha Atomic Research Centre, Bombay). Sci. Today (Bombay).; 9: No. 3, 28-34(Sep 1974).

Techniques employed to measure seismic effects due to an earthquake or underground nuclear explosion are described. The structure of the earth is also briefly described. Four types of seismic waves are defined and explained. The energy of an earthquake or an underground explosion is estimated by measuring the maximum amplitude of ground motion produced by waves in the range 0.5 to 2 Hertz. The frequency spectra of signals indicate the intensity of the event and help to differentiate between earthquake and underground explosions. The intensity is measured in terms of a magnitude m_b in Richter scale. The method of measurement of magnitudes using Rayleigh wave phase is also explained. The importance of sensitive seismologic techniques gaining more knowledge about the interior of the earth, in predicting earthquakes, in locating oil and natural gas regions and in monitoring nuclear explosions throughout the world are pointed out. (INIS)

11503 INTER-UNIVERSITY TECHNOLOGY ASSESSMENT PROJECT. Wham, G. A. (Univ. of New Mexico, Albuquerque). Trans. Am. Nucl. Soc.; 21: 76(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

Protective Structures and Equipment

11504 (RFP-2358) QUANTITATIVE RESPIRATOR MAN-TESTING AND ANTHROPOMETRIC SURVEY. Leigh, J. D. (Dow Chemical U. S. A., Golden, Colo. Rocky Flats Div.). 22 May 1975. Contract AT(29-1)-1106. 12p. Dep. NTIS $4.00.

Results are reported of a recent anthropometric survey and test procedures related to the respiratory protection program to safeguard the health of personnel. Respiratory protection procedures involve the selection of face masks worn by plant personnel. The fitting, handling, and use of face masks through explicit instructions can assure optimum protection. Comparisons are made with the test-panel selection parameters established by the Los Alamos Scientific Laboratory in Los Alamos, New Mexico, and recommendations by Webb Associates of Yellow Springs, Ohio. (auth)

11505 CONSTRUCTION AND EQUIPMENT OF A RADIO-NUCLIDE LABORATORY. de Vries, J. Polytech. Tijdschr. Bouwkunde Wegen-en Waterbouw.; 30: No. 3, 93-99(5 Feb 1975). (In Dutch).

The future users of the laboratory, the building section of the client's firm, the architect, advisers on installation technique, the radiation protection service, the Ministry of Social Affairs and the radiation section of the public health authority, should be consulted from the start. Assessments should be made of the toxic products to be used and provision should be made for regular measurements of radiation levels and dosages received by personnel. The details of the laboratory will differ in each individual case; suggested layouts are given for laboratories handling material with three different degrees of toxicity. Present-day protective methods provide acceptably safe working conditions, unless very serious accidents occur. (auth)

11506 RADIO OPAQUE GLOVES. Whittaker, A. V.; Whittaker, R. E. Jr.; Goldstrom, R. A.; Shipko, F. J. (to Arco Nuclear Co.). US Patent 3,883,749. 13 May 1975. Filed date 15 Aug 1972. 8p.

Radiation shielding garments and accessories, such as radio-opaque gloves for surgeons, shielding against the harmful x-ray radiation in a fluoroscopic zone, are advantageously different from garments for shielding from other medical uses of x-rays. Such garments are provided with zones of differing opacity, whereby desired sensitivity and "feel" through the glove material is retained. One feature is the provision of an "opacity gradient" across the glove cross section with opacity being relatively low at the fingertip area (lesser shield-thickness), but relatively high at the less nonprehensile hand zones, such as the palm. Glove fabrication techniques for achieving such an opacity gradient are described. (Official Gazette)

11507 AIR FILTERS AND PLUTONIUM. Orth, D. A. (E. I. duPont de Nemours and Co., Aiken, SC). Trans. Am. Nucl. Soc., 21: 327(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11508 ABSCHIRMWAENDE GEGEN IONISIERENDE STRAHLUNG. Spezielle Bauelemente. (Walls Shielding Against Ionizing Radiation. Special Construction Elements). Berlin; Beuth (1974). 30p. (DIN-25407).

The described special construction elements together with lead bricks serve to build complete shields for hot cells. (GE)

11509 ABSCHIRMWAENDE GEGEN IONISIERENDE STRAHLUNG. Spezielle Bauelemente, Hinweise fuer die Verwendung. (Walls Shielding Against Ionizing Radiation. Special Construction Elements, Recommendations for Use). Berlin; Beuth (1974). 4p. (In German).

Recommendations for use of special construction elements are presented. (GE)

ENVIRONMENTAL AND EARTH SCIENCES

Minerals and Ores

Refer also to abstracts 11137 and 11623.

11510 (AED-CONF-74-600-009) THE PRESENT SUPPLY SITUATION OF THE ENERGY SUPPLY UTILITIES IN THE MOST IMPORTANT COUNTRIES (GERMAN FEDERAL REPUBLIC EXCLUDED). Stephany, M. (Nuklear-Chemie und-Metallurgie G.m.b.H. (NUKEM), Grossauheim (F. R. Germany)). Nov 1974. 17p. (In German). INIS.

From symposium on natural uranium supply; Mainz, F. R. Germany (18 Nov 1974).

The policies and situation of a number of industrialized nations with respect to the supply of natural uranium are investigated under the aspects of national economy with the objective of obtaining some indications as to activities in the Federal Republic of Germany. The sales policies of all countries have changed. Uranium deposits have become a trading commodity and the creation of stockpiles has become a generally accepted goal. Factors influencing the assessment of the future requirement are the enrichment policy, reprocessing, and reactor strategies. (GE)

11511 (AED-CONF-74-600-010) THE PAST AND FUTURE ROLE OF THE GERMAN URANIUM COMPANIES. von Kielin, A. (Urangesellschaft m.b.H. und Co. K. G., Frankfurt am Main (F. R. Germany)). 1974. 27p. (In German). INIS.

From symposium on natural uranium supply; Mainz, F. R. Germany (18 Nov 1974).

After an outline of the history, the purpose and the structure of the shareholders of the German uranium companies the approaches chosen so far are described and the external impacts on the activities of these industries and the situation encountered when working abroad between 1968 and 1973 are dealt with. Moreover, the results so far achieved by these companies are reported and the activities necessary for these industries to adapt themselves to the new situation in the uranium are presented. (GE)

11512 USE OF OXYGEN ISOTOPE RATIOS IN CORRELATION OF TUFFS, EAST RUDOLF BASIN, NORTHERN KENYA. Cerling, T. E.; Biggs, D. L.; Vondra, C. F.; Svec, H. J. (Iowa State Univ. of Science and Technology, Ames (USA)). Earth Planet. Sci. Lett.; 25: No. 3, 291-296(Apr 1975).

Oxygen isotope determinations were made using CoF_3 to extract oxygen from 27 volcanic glass samples from the East Rudolf Basin, northern Kenya. Results show that the older tuffs are progressively enriched in ^{18}O and that this index can be used in the correlation of volcanic ash units. This method could not distinguish individual samples from the youngest units studied because their ranges of $\delta^{18}O$ overlap. The $\delta^{18}O$ values for the shards in the Tulu Bor Tuff, the KBS Tuff, the Koobi Fora Tuff, and the Chari Tuff range from 14.5 to 16.4, from 8.9 to 9.5, from 6.6 to 7.0, and from 7.0 to 7.2, respectively, in decreasing age. Determination from pumice cobbles are consistently higher than the above values. (auth)

11513 ADDITIONAL NOTE ON THE ISOTOPIC COMPOSITION OF STRONTIUM IN McCARTYS FLOW, VALENCIA COUNTY, NEW MEXICO. Brookins, D. G. (New Mexico Univ., Albuquerque (USA)); Carden, J. R. (Alaska Univ., College (USA). Geophysical Inst.); Laughlin, A. W. (Los Alamos Scientific Lab., N. Mex. (USA)). Earth Planet. Sci. Lett.; 25: No. 3, 327-330(Apr 1975).

Strontium isotopic analyses of additional samples of the McCarty's basalt flow (Holocene) exhibit no evident correlation with distance from the source crater or with strontium content. This confirms previous comments urging caution in sampling of one basalt flow in order to determine its "source" initial $^{87}Sr/^{86}Sr$. (auth)

11514 CONTRIBUTION TO THE STUDY OF THORIUM AND POTASSIUM BEHAVIOR IN SEDIMENTARY ROCKS. Hassan, M. (Paris-6 Univ., 75 (France)); Hossin, A. (Compagnie Francaise des Petroles, 75-Paris). C. R., Ser. D.; 280: No. 5, 533-535 (3 Feb 1975). (In French).

After studying varied samples by gamma spectrometry, a correlation between thorium and aluminum was observed on one hand and between the ratio Th/K and the mineralogical nature of the clay fraction on the other hand. The ratio Th/K can be used to characterize sedimentary facies and to reconstitute the paleogeography and eventually the paleoclimate. (FR)

11515 URANIUM MINERALIZATION BY GROUND WATER IN SEDIMENTARY ROCKS, JAPAN. Doi, K.; Hirono, S.; Sakamaki, Y. (Power Reactor and Nuclear Fuel Development Corp., Tokyo). Econ. Geol.; 70: No. 4, 628-646(1975).

To solve the mechanism of uranium concentration in stratabound uranium deposits occurring in the basal part of Neogene sediments overlying granite basement, attention was paid to uranium leaching from weathered granite by circulating carbonated fissure waters, to effective adsorbents for fixing uranium from uraniferous ground waters, to structural features controlling the ground-water circulation, and other relevant factors. The evidence for uranium transportation by hydothermal solutions, including hot spring waters, is hard to observe. Conclusions are summarized as follows: Uranium in the deposits is supplied from surrounding source rocks, mostly from granite. Uranium is transported by circulating ground-water solutions. The uranium dissolved in ground water is fixed in minerals in various ways, the most important being adsorption by carbonaceous matter. Ore-grade uranium concentrated from very dilute solutions occurs by multiple repetition of a leaching-and-fixation cycle between minerals or adsorbents and circulating uraniferous ground water. Important factors for uranium mineralization are sufficient uranium, supplied mostly from granite, the existence of effective adsorbents such as carbonaceous matter in the host rocks, and favorable geological, geochemical, and geophysical environments. The last seem to require not only physical and chemical conditions but also correct flow and volume of ground water. (auth)

11516 URANIUM ANALYSIS METHODS IN EXPLORATION, MINING, AND MILLING. Eichholz, G. G. (Georgia Inst. of Tech., Atlanta). Trans. Am. Nucl. Soc.; 21: 139-140(Jun 1973).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11517 URANIUM RESOURCES: ARE THEY ADEQUATE. Nininger, R. D. (Energy Research and Development Administration, Washington, DC). Trans. Am. Nucl. Soc.; 21: 241(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11518 U_3O_8 SUPPLY IN TECHNOLOGICAL AND COMMERCIAL TRANSITION. Schutt, P. F.; Hobbs, J. S. (Nuclear Assurance Corp., Atlanta). Trans. Am. Nucl. Soc.; 21: 241-243(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11519 CHANGING SCENE FOR URANIUM IN CANADA. O'Brien, N. (Denison Mines Ltd., Toronto). Trans. Am. Nucl. Soc.; 21: 243(Jun 1975)

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11520 URANIUM: THE MARKET AND ADEQUACY OF SUPPLY. Cherry, B. H. (GPU Service Corp., Parsippany, NJ). Trans. Am. Nucl. Soc.; 21: 243-244(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11521 URANIUM RESOURCES OF THE UNITED STATES. Boyden, T. A. (Nuclear Exchange Corp., Menlo Park, CA) Trans. Am. Nucl. Soc.; 21: 244-245(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11522 URANIUM MINING TECHNIQUES AND ENVIRONMENTAL IMPLICATIONS. Balzer, J. L. (Utah International, Inc., San Francisco). pp vp of Land Use Planning. New York; Atomic Industrial Forum, Inc. (1974).

From proceedings on land use planning; San Francisco, California, USA (16 Jun 1974). See CONF-740697-.

The site of the uranium bearing ore body in the Shirley Basin area of Wyoming is described. The land use in Shirley Basin is dominated by the activity of mining and milling industries. Uranium mining operations are described. All solid liquid wastes generated at the mills are impounded in a tailings retention system. Airborne effluents from various processes are monitored for total particulate mass and U_3O_8 in the samples. (HLW)

11523 THE NATURAL URANIUM SUPPLY POLICY OF THE GERMAN ELECTRICITY SUPPLY UNDERTAKINGS. Roth, B. (Badenwerk A. G., Karlsruhe (F. R. Germany). Abt. Kernkraftwerke). At. Strom; 21: No. 1-2, 2-4(Jan 1975). (In German).

From symposium on natural uranium supply; Mainz, F. R. Germany (18 Nov 1974).

An introduction into the new situation of the uranium market is followed by a summary outline of the most important features of price development, requirements, reserves, and supply policy concerning natural uranium as it is seen by an electricity supply utility. (GE)

11524 CHARACTERISTIC PATTERN OF DISEQUILIBRIUM IN SOME URANIUM ORE DEPOSITS. Santos, E. S. J. Res. U. S. Geol. Surv.; 3: No. 3, 363-368(1975).

A redistribution of radium-226 in uranium ore deposits produces a characteristic pattern of disequilibrium in which uranium is greater than equivalent uranium in high-grade samples and equivalent uranium is greater than uranium in low grade samples. The redistribution is a continuous process in uranium deposits, and the resulting pattern of disequilibrium is itself a system in equilibrium. (auth)

Radioactive Effluents

Refer also to abstracts 11522, 11540, and 13452.

11525 DYNAMIC SYSTEM ANALYSIS OF THE ENVIRONMENTAL IMPACT OF AN LMFBR PROGRAM. Wayland, J. R.; Chapman, L. D. (Sandia Labs., Albuquerque, NM); Cuddihy, R. G.; Dugan, V. L.; McClellan, R. O. Trans. Am. Nucl. Soc.; 21: 91(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11526 CARBON-14 GASEOUS EFFLUENTS FROM BOILING WATER REACTORS. Kunz, C. O.; Mahoney, W. E.; Miller, T. W. (NY State Dept. of Health, Albany). Trans. Am. Nucl. Soc.; 21: 91-92(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11527 DOSE ASSESSMENT MODELS FOR ATMOSPHERIC RELEASES. Eckerman, K. (Nuclear Regulatory Commission, Washington, DC). Trans. Am. Nucl. Soc.; 21: 521(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11528 SITE ENVELOPE APPROACH TO DOSE ASSESSMENT FOR A STANDARDIZED NUCLEAR POWER PLANT DESIGN. DiSabatino, A. A. Jr. (Stone and Webster Engineering Corp., Boston). Trans. Am. Nucl. Soc.; 21: 521(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11529 FIELD TESTING IN SUPPORT OF LOW-WIND-SPEED DIFFUSION STUDIES. Dickson, C. R.; Sagendorf, J. F. (National Oceanic and Atmospheric Administration, Idaho Falls, ID). Trans. Am. Nucl. Soc.; 21: 522-523(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11530 DISPERSION OF TRACER GAS AT THE RIVER BEND SITE. Shearer, D. L. (Research Corp. of New England, Wethersfield, CT); Entrekin, H. D. Trans. Am. Nucl. Soc.; 21: 523(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11531 LAND USE PLANNING. Proceedings of a Conference Held at San Francisco, California, June 16–19, 1974. New New York; Atomic Industrial Forum, Inc. (1974). vp. (CONF-740697-). $20.00.

Separate abstracts were prepared for two papers presented at the conference. (HLW)

For abstracts of individual papers see: 11522 and 11532.

11532 AEC EVALUATION OF PROGRAMS FOR MANAGEMENT OF COMMERCIAL RADIOACTIVE WASTE. Pittman, F. K. (Atomic Energy Commission, Washington DC). pp vp of Land Use Planning. New York; Atomic Industrial Forum, Inc. (1974).

From proceedings on land use planning; San Francisco, California, USA (16 Jun 1974). See CONF-740697-.

It is pointed out that there are four fundamental means for managing radioactive wastes, as follows: conversion of radionuclides in the waste to short-lived or stable isotopes (transmutation); removal of the waste completely from the planet (extraterrestrial disposal); retention of the waste on the earth in locations where it is completely outside of the biological environment (geologic disposal); and retention of the waste in monitored, maintained, high-integrity, properly shielded and cooled containers (surface storage). Geologic disposal and surface storage are discussed in detail. The following topics are also discussed: responsibility for storage of waste, form of radioactive waste for extended storage, and the impact of cost of managing radioactive waste. (HLW)

11533 RADIOACTIVE EMISSIONS FROM POWER PLANTS FUELED WITH BROWN COAL FROM THE RHINE REGION. Kirchner, H.; Merz, E. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Chemische Technologie); Schiffers, A. (Rheinisch-Westfaelisches Elektrizitaetswerk A. G., Essen (F. R. Germany). Abt. Kraftwerksbetrieb). Braunkohle; 26: No. 11, 340-345(1974). (In German).

The trace amounts of Th and U have been measured using γ-spectroscopy and activation analysis in a series of samples of brown coal of the Rhine region and its combustion filter ashes from precleaning, intermediate cleaning, and post-cleaning (separation efficiency of the filter plants up to 99.9%). The resulting radioactive emissions of gases and aerosols under different operating conditions have been calculated. (GE)

Radioactivity Monitoring and Transport

Refer also to abstracts 11141, 11554, and 12198.

11534 ^{137}Cs IN LAKE MICHIGAN SEDIMENTS. Plato, P. (Univ. of Michigan, Ann Arbor). Health Phys.; 28: No. 5, 635-636(May 1975).

The author responds to a letter by Edgington and Ritchie which commented on his paper concerning ^{137}Cs in Lake Michigan sediments (Health Phys; 26: 489 (1974)). The criticism of the use of grab samples to measure the ^{137}Cs content in sediment and the concern expressed about the calculation that a maximum of 20% of the ^{137}Cs that has entered the St. Joseph River watershed is now in the sediments of Lake Michigan near Benton Harbor are discussed. It is agreed that the direct atmospheric contribution of ^{137}Cs should have been discussed as a source of sediments in the lake shown in the paper. (UK)

11535 PHYSICAL METHODS FOR ENVIRONMENTAL MONITORING IN THE VICINITY OF NUCLEAR FACILITIES. Tschurlovits, M.; Unfried, E. (Atominstitut der Oesterreichischen Hochschulen, Vienna). Atomkernenergie; 25: No. 1, 1-18(1975). (In German).

In the present paper a review about measuring methods, used for environmental monitoring in the vicinity of nuclear installations is given. The main subject is the description of physical methods. The paper is divided into sections: Measurement of gross radioactivity, identification of unknown radionuclides, determination of selected radionuclides (tritium, potassium 40, isotopes of iodine and strontium, cesium 137, natural radioactive families and plutonium) and finally the measurement of external radiation. (auth)

Atmosphere

Refer also to abstract 13493.

11536 ENVIRONMENT AND NUCLEAR ENERGY. IV. Use of Energy and Its Relation With the Environment. Wright, J. H. Energ. Nucl. (Madrid); 19: No. 94, 111-114(1975). (In Spanish).

The pollution of the air as a result of the use of energy and the effect that nuclear energy can have on the quality of the environment are studied. After an analysis of energy consumption in various areas, its annual increase, and its extrapolation to the year 2000, the principal pollutants of the air and their effects on animals and plants are discussed. Numerical values are given for the pollutants emitted by various energy uses in the period from 1940 to 2000 and their possible reductions by substituting electrical energy for other types of energy are analyzed. The effect of substituting nuclear power plants for fossil-fuel power plants on the atmospheric pollution is considered. (tr-auth)

11537 FACILITY FIELD MONITORING COST/BENEFIT ANALYSIS. Anno, G. H.; Montgomery, H. (Pacific-Sierra Research Corp., Santa Monica, CA). Trans. Am. Nucl. Soc.; 21: 89-90(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11538 CONTINUOUS MONITORING SYSTEM FOR ^{85}Kr IN THE ENVIRONMENT. Beck, H. L.; Freeswick, D. C. (Atomic Energy Commission, New York). Trans. Am. Nucl. Soc.; 21: 92-93(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11539 ATMOSPHERIC DISPERSION EXPERIMENTS SUPPORTED BY ERDA. Abbey, R. F. Jr. (Energy Research and Development Administration, Washington, DC). Trans. Am. Nucl. Soc.; 21: 521-522(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11540 REVIEW OF ATOMIC INDUSTRIAL FORUM ROOF-VENT-RELEASE TEST PROGRAM. Johnson, W. (Stanford Research Inst., Menlo Park, CA). Trans. Am. Nucl. Soc.; 21: 523(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11541 RADIOAKTIVNOST' ATMOSFERY I METEOROLOGIYA. (Atmospheric Radioactivity and Meteorology). Styro, B. I. (ed.). Vilnyus, USSR; Izdatel'stvo Mintis (1975). 272p.

It was shown that by use of natural radioisotopes occurring in the atmosphere and by artificial radioisotopes resulting from human activities it is possible to study a series of phenomena of atmospheric physics impossible or difficult to study by other methods. Because of very precise methods for the determination of the presence of vanishingly small radioisotopic contaminants, it is possible to measure the coefficient of turbulent diffusion in the atmosphere, to study the vertical and horizontal exchanges of air masses on a large scale, to study a series of transient characteristics of the physical processes in the atmosphere, to solve problems of cloud physics, and to evaluate the magnitude of the washout and fallout of dust from the atmosphere. (tr-auth)

Soil

Refer also to abstract 11256.

Water

11542 ^{241}Pu IN THE MARINE ENVIRONMENT BY A RADIOCHEMICAL PROCEDURE. Livingston, H. D.; Schneider, D. L.; Bowen, V. T. (Woods Hole Oceanographic Institution, Mass. (USA)). Earth Planet. Sci. Lett.; 25: No. 3, 361-367(Apr 1975).

A purely radiochemical method is described for analysis of ^{241}Pu in environmental samples. Data are given showing that fallout-contaminated marine samples, of several kinds and provenances, exhibit ^{241}Pu/^{239,240}Pu ratios slightly higher than, but not certainly distinguishable from, those reported for fallout-contaminated soils. Such ratios, however, in samples from several planned or accidental Pu releases, are clearly different, suggesting ^{241}Pu will be a useful tracer in following the spread of released Pu. The data have also clear implications for the source, and growth, of environmental ^{241}Am. (auth)

11543 WATER TRANSPORT THROUGH LAKE KINNERET SEDIMENTS TRACED BY TRITIUM. Stiller, M.; Carmi, I. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Isotopes); Muennich, K. O. (Heidelberg Univ. (F. R. Germany)). Earth Planet. Sci. Lett.; 25: No. 3, 297-304(Apr 1975).

The transport of water through the sediments of Lake Kinneret was estimated using tritium of fallout origin as a tracer. The calculation model takes into account the diffusion of the tracer and its decay, and allows for the advective flux through the sediment pores as a free parameter. The dependence of the interstitial diffusion constant on the porosity was assumed identical to that for chloride ions. Tritium profiles in nine cores were used for estimating the advective fluxes and velocities, by finding the best fit between data and model. Water advective fluxes of 3.4 g cm^{-2}yr^{-1} into the lake were found. This water flux is negligible in the hydrological balance of Lake Kinneret; but it carries along 7% of the unaccounted-for chloride input to the lake. (auth)

11544 AN EXPERIMENTAL STUDY OF ZINC CYCLE IN THE POND OF THE OLIVIER. Baudin, J. P. (Aix-Marseille-1 Univ., 13-Marseille (France); CEA Centre d'Etudes Nucleaires de Cadarache, 13-Saint-Paul-les-Durance (France). Lab. de Radioecologie Continentale). Vie Milieu; 24: No. 1, 59-80(1974). (In French).

Several radioecological data were obtained from three groups of experiments with zinc-65 used as a tracer. The transfer of the radiozinc from the water into the sediment was recorded for various temperatures in three stations of the lagoon. The fixation and the elimination of zinc-65 by algae of the genus Cladophora were studied. The last part of this work concerns the transfer of the radioelement from this algae to the Gasteropod Physa acuta and to an Isopod Sphaeroma hookeri Leach. (FR)

11545 DISTRIBUTION OF PLUTONIUM AND AMERICIUM IN BIKINI ATOLL. Nevissi, A.; Schell, W. R. (Univ. of Washington, Seattle). Health Phys.; 28: No. 5, 539-547(May 1975).

Important factors that govern the redistribution and transport of radionuclides in Bikini Atoll Lagoon are particulate size and physical-chemical state. The radionuclides measured include ^{239,240}Pu and ^{241}Am. The largest source of radionuclides available for transport as indicated by ^{241}Am and ^{239,240}Pu in sediments and water samples reside in the deep water in the northwestern quadrant of the lagoon within approximately 6 km south of the second thermonuclear detonation - Shot Bravo. Small particles and/or ions of radionuclides are released at the sediment-water interface and are transported by the currents. These particles and ions agglomerate during transport away from the sediment surface. Coagulation with detritus and incorporation with plankton would cause the effective particulate size to increase. After about 16 yr, since the last nuclear test on the Atoll, the radionuclides are neither buried totally in the lagoon sediments nor have they been discharged completely to the ocean. There is a constant circulation and redistribution of the materials in the lagoon enforced by prevailing lagoon currents. The flux of americium and plutonium away from Bikini Atoll and into the North Equatorial Current are calculated to be about 3 Ci ^{241}Am and 6 Ci ^{239,240}Pu per year. (auth)

Ecosystems and Food Cycles

Refer also to abstract 11865.

11546 CESIUM-137 AND STABLE CESIUM IN A HYPEREUTROPHIC LAKE. Eyman, L. D.; Kevern, N. R. (Michigan State Univ., East Lansing). Health Phys.; 28: No. 5, 549-555 (May 1975).

The inputs of ^{137}Cs and stable cesium and their distribution among the water, sediments, macrophytes, filamentous algea, zooplankton, and several species of fish were studied in a lake exhibiting an advanced stage of eutrophy. Most of the cesium pool (97% ^{137}Cs; 98% stable cesium) was found to be associated with the sediments. Stable cesium enters the lake primarily in a bound state as migratory waterfowl excreta and is deposited to the sediments. Cesium-137 is associated with fine particulates in the inorganic form as it enters the lake. This results in a longer residence time in the water column with distribution throughout the lake. Specific activity (pCi ^{137}Cs/ng stable Cs) of the sediments was lower than other components of the system due to the different modes of entry for the two cesium isotopes. A trend of increased ^{137}Cs concentration at higher trophic levels was demonstrated for fish that are free-ranging limnetic feeders. No such trend was evident for stable cesium. Fauna closely associated with sediments appear to have higher ^{137}Cs concentrations than would be expected based on their feeding habits. On the dates samples were collected, specific activity in limnetic fishes was constant but was variable in other forms. The degree of association of biota with sediments was reflected by specific activities. (auth)

11547 ECOLOGICAL CONSIDERATIONS OF THE BEHAVIOR OF PLUTONIUM IN THE ENVIRONMENT. Hanson, W. C. (Los Alamos Scientific Lab., NM). Health Phys.; 28: No. 5, 529-537 (May 1975).

Radiological considerations of plutonium released to the environment are logically based upon an understanding of ecosystem structure and function. Studies of Pu in the atmosphere, lithosphere, terrestrial ecosystem of the biosphere, and in the hydrosphere are reviewed to evaluate areas for consideration of environmental consequences of nuclear wastes. Soil is the major reservoir of deposited Pu in most terrestrial ecosystems. Resuspension of Pu into the air mass above contaminated soil occurs over a highly variable range of 10^{-2} to 10^{-11}m^{-1}, reflecting important effects of several physical and biological variables. Uptake by most natural plant species is of the order of 10^{-4} (acceptor/precursor). Appreciable external deposition of Pu upon plants through resuspension is a complicating factor in interpretation of field data. Pu concentrations in small terrestrial mammals also emphasize the greater importance of physical processes rather than physiological or chemical processes in the movement of Pu through terrestrial ecosystems. Freshwater and marine investigations indicate that Pu is generally concentrated over ambient levels in water but with decreases of about a factor of ten at each trophic level of a food chain. An apparent change in availability of ^{238}Pu is indicated by several studies and physical processes that may account for this are discussed. (auth)

11548 HAZARD EVALUATION OF DRY DEPOSITION OF $^{131}I_2$ ON SURFACE WATERS IN THE VICINITY OF A NUCLEAR

POWER PLANT. Allen, M. D.; Neff, R. D. (Texas Agricultural and Mechanical Univ., College Station). Health Phys.; 28: No. 5, 623-624(May 1975).

Hypothetical calculations were carried out of the concentration of $^{131}I_2$ in shallow water due to deposition. This exposure route is normally not evaluated. It is shown that even though the radiation doses that can be received by man via this pathway are not significant yet they are comparable to, or in some cases, many times the thyroid dose from iodine released as a liquid effluent, a pathway routinely evaluated. (UK)

Radiometric Techniques

Refer also to abstracts 11541 and 11869.

11549 WEYL'S THEORY OF GLACIATION SUPPORTED BY ISOTOPIC STUDY OF NORWEGIAN CORE K 11. Duplessy, J. C.; Chenouard, L.; Vila, F. (CNRS-CEA, Gif-sur-Yvette, France). Science; 188: No. 4194, 1208-1209(20 Jun 1975).

Oxygen-18 analyses of pelagic and benthic foraminifera from core K 11 indicate that during the last glaciation Norwegian Sea bottom waters were warmer than in modern times and had the same physical parameters (temperature, oxygen isotope ratio, and salinity) as the North Atlantic deep water. This result indicates that the glacial Norwegian Sea was not a sink for dense surface water, as it is now, and that during glacial times North Atlantic deep water invaded the deep Norwegian basin. (auth)

11550 IN-SITU BOREHOLE LOGGING OF GEOLOGIC MATERIALS BY NEUTRON CAPTURE-GAMMA-RAY MEASUREMENT. Nargolwalla, S. S. (Scintrex Ltd., Concord, Ont.). Trans. Am. Nucl. Soc.; 21: 107(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

Site Surveys

Refer also to abstracts 12253 and 13075.

Thermal Effluents

Refer also to abstract 11696.

11551 (AECL-4924) ASSESSMENT OF NUCLEAR POWER PLANT WASTE HEAT UTILIZATION FOR FRESHWATER FISH FARMING. Guthrie, J. E.; Prowse, D. R.; Scott, D. P. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). May 1975. 47p.

The feasibility and economic potential of aquaculture are discussed and the commercial prospects for intensive fish farming in Canada are examined. The major environmental parameters, particularly water temperature, which affect fish farming in Canada are reviewed. Fish must be reared for marketing on a schedule similar to that used for a beef cattle feedlot operation. This requirement implies a uniform rate of production which can be achieved by manipulation of the food feeding rate and the fishes' environmental temperature. However, it has not been economically feasible to heat the water supplied to a fish rearing facility. The condenser cooling water from a CANDU nuclear power station, such as Pickering in Ontario, is an abundant source of warm water at a constant temperature suitable for intensive aquaculture. The quantity of condenser cooling water discharged from one 600 MW(e) reactor could, potentially, be used to achieve an annual production of at least 12 Gg (12,000 tonnes) of rainbow trout. There are several potential difficulties associated with the use of a nuclear power station's cooling water for aquaculture. Will the public eat fish reared in the effluent from a nuclear power station? Can a uniform production rate be achieved and can disease be controlled? Therefore, the feasibility of using nuclear power station condenser cooling water for intensive aquaculture must be demonstrated on a pilot-plant scale before attempting any commercial venture. A pilot plant or demonstration module is described. (auth)

11552 CORRELATION FOR THE ENTRAINMENT FUNCTION FOR NEARFIELD THERMAL PLUME ANALYSIS. Ginsberg, T. (Brookhaven National Lab., Upton, NY); Ades, M. Trans. Am. Nucl. Soc.; 21: 87-88(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11553 EVALUATION OF COOLING TOWER ECOLOGICAL EFFECTS: AN APPROACH AND CASE HISTORY. Mudge, J. E. (Metropolitan Edison Co., Reading, PA); Firth, R. W. Jr. Trans. Am. Nucl. Soc.; 21: 90(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

Chemical Effluents

Refer also to abstracts 11143 and 11540.

11554 (BNWL-SA-5404) NEW DIRECTIONS IN HEALTH PHYSICS. Vaughan, B. E. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Apr 1975. 10p. (CONF-750503-21). Dep. NTIS $4.00.

From 4th national symposium on radioecology; Corvallis, Oregon, USA (12 May 1975).

Present statutory and other requirements placed on health physics groups include many areas besides that of radiological monitoring. It is not unusual for health physics groups to also monitor metal contamination and accidental release of certain toxic chemicals. The general approach in terms of medical surveillance, monitoring, sampling, and measurement technology will be applicable outside the nuclear area. With the creation of the U.S. Energy Research and Development Administration, and with abolition of the former U.S. Atomic Energy Commission, it is clear that technologies beyond strictly nuclear technology will be implemented to meet energy needs of the next decade. The impact of some of these technologies for electric power production on the environment are discussed with emphasis on coal. It is pointed out that coal consumption can be expected to increase, and the scale of operation for individual plants can be unbelievably large. The contributions of nuclear power plants and fossil fuels to meet energy demands by the year 2000 are estimated. Both health and environmental implications of such operations are discussed in relation to anticipated research and monitoring programs. (CH)

INSTRUMENTATION

Radiation Detection Instruments

11555 EFFECTS OF SMOOTHNESS OF RESPONSE MATRICES ON UNFOLDING RADIATION DATA. Kirmser, P. G. (Kansas State Univ., Manhattan); Hu, K. K.; Meyer, W. Trans. Am. Nucl. Soc.; 21: 536-537(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

General Detectors and Monitors

Refer also to abstracts 11535, 11630, 11831, 11843, 11844, 11850, 11984, and 12835.

11556 (RFP-2381) LOGARITHMIC TRANSFORMED STATISTICAL MODELS IN CALIBRATION. Zeis, C. D. (Dow Chemical U. S.A., Golden Colo. Rocky Flats Div.). 13 Jun 1975. Contract AT(29-1)-1106. 11p. Dep. NTIS $4.00.

A general type of statistical model used for calibration of instruments having the property that the standard deviations of the observed values increase as a function of the mean value is described. The application to the Helix Counter at the Rocky Flats Plant is primarily from a theoretical point of view. The Helix Counter measures the amount of plutonium in certain types of chemicals. The method described can be used also for other calibrations. (auth)

11557 (RL-75-049) NEW RANGE OF ADAPTABLE EQUIPMENT FOR MULTIWIRE PROPORTIONAL CHAMBER READOUT. White, D. J. (Science Research Council, Chilton (UK). Rutherford Lab.). Jan 1975. 19p. Dep. NTIS (US Sales Only) $4.00.

Design requirements, performance specifications and system organization of a new range of adaptable MWPC readout equipment, designed and produced by the HEP electronics group of the Rutherford Laboratory are presented. (auth)

11558 (ZFK-283, pp 121-122) STUDIES ON ION-IMPLANTED Si DETECTORS. Deutscher, M.; Doering, O.; Rother, U.; Weise, C. Aug 1974. (In German).

In joint annual report, 1974.

11559 A SIMPLE RISETIME DISCRIMINATOR FOR X-RAY PROPORTIONAL-COUNTER BACKGROUND REDUCTION. Doi, K. (Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science). Nucl. Instrum. Methods; 125: No. 1, 183-187(15 Mar 1975).

A simple risetime discriminator for the x-ray proportional counter has been developed and tested for Xe and Ar gas counters. It is shown that the background-reduction performance depends on the kind of gas as well as the x-ray energy range, but on the whole the background was reduced by one order of magnitude. A discussion is made also on the shape of the risetime distribution of the x-ray pulses, which has a crucial effect on the efficiency of the risetime discrimination. (auth)

11560 ELUTION OF RECOILED FRAGMENTS FROM FISSION TRACKS BY CHEMICAL ETCHING. Yoshida, K. G.; Miyajima, K.; Honda, M. (Tokyo Univ. (Japan). Inst. for Solid State Physics). Nucl. Instrum. Methods; 125: No. 1, 149-155(15 Mar 1975).

Polycarbonate films, which were exposed to fission fragments, were treated with different etching reagents. It was found that a dilute alcoholic solution of strong base gave an outstandingly higher etching rate than any aqueous solution. Etching with the alcoholic solution could conveniently be performed at room temperature. The etching rates by methanol solutions of the organic base R_4NOH, KOH, and NaOH were in the ratio of 4:2:1. The rates were found to be independent of aliphatic chain length of alcohols between methyl and amyl. When polycarbonate film irradiated from a fission source through 1 cm air was treated with 1 M KOH in methanol for 20 min, ca. 80% of the heavy fragments of uranium were leached out, whereas most of the light ones still remained in the target. Heavy atoms make shorter tracks than light ones according to their fission recoil energy and it appears that the elution rate depends only on the range of the fragments in the film. The difference in the formations of heavy and light tracks could be observed continuously when the etching was performed under a microscope. (auth)

11561 AUTOMATIC DETECTION OF THE RECORDED EVENTS IN THE NUCLEAR EMULSION. Matte, J. P.; Hebert, J. (Ottawa Univ., Ontario (Canada)). Nucl. Instrum. Methods; 125: No. 1, 93-97(15 Mar 1975). (In French).

The programming involved in track and star recognition in the nuclear emulsion is described for a flying-spot device using an X and Y digitized television screen on-line to a 4K PDP8/E mini-computer. (auth)

11562 AN IDEALIZED THEORY OF THE GAMMA-RAY DETECTION MECHANISM OF A SIMPLE MOXON-RAE-TYPE DETECTOR. Malik, S. S. (Rhode Island Univ., Kingston (USA). Dept. of Physics). Nucl. Instrum. Methods; 125: No. 1, 45-52 (15 Mar 1975).

A theory of the gamma-ray detection mechanism of a simple Moxon-Rae detector is proposed. The development of the theory is presented in terms of the probability functions appropriate to the production and transmission of electrons resulting from the (γ,e) processes in the converter material. The converter in this treatment is assumed to be graphite and the (γ,e) processes are taken to be Compton scattering. The assumptions made in the calculations of the various probabilities are discussed. Brief discussions of the gamma emission probability (strictly of nuclear origin) and the geometrical probability (indicating the effects of angular correlations) have also been included. The treatment shows that approximate linearity of the γ-detection efficiency derives jointly from the electron-production and -transmission probability functions. The sharp decrease in the γ-detection efficiency from linearity for $E_\gamma < 1$ MeV is characteristic of the proposed theory and is in general agreement with the experimental observations. Directions for further refinement of the theory have been suggested. (auth)

11563 ON THE CAREFUL DETERMINATION OF GAMMA-RAY ANGULAR DISTRIBUTIONS IN $(\alpha,x\gamma)$ REACTIONS: EXAMPLE OF THE $^{186}W(\alpha,7\gamma)^{183}Os$ REACTION. Jaeger, H. M.; Beuscher, H.; Davidson, W. F.; Lieder, R. M.; Neskakis, A. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik). Nucl. Instrum. Methods; 125: No. 1, 53-59 (15 Mar 1975).

Using the reaction $^{186}W(\alpha,7\gamma)^{183}Os$ as an example the measurement and analysis procedures of γ-ray angular distributions following $(\alpha,\chi n)$ reactions are outlined and discussed. Special emphasis has been devoted to the factors influencing the accuracy that can be obtained in such γ-ray angular distribution measurements. (auth)

11564 ENERGY TRANSFER IN DIOXANE BASE LIQUID SCINTILLATORS BY MEASUREMENT OF SCINTILLATION YIELDS. Bourdeaux-Pontier, M.; Roux, F.; Briand, C. (Aix-Marseille-3 Univ., 13-Marseille (France)). J. Chim. Phys.; 71: No. 11, 1455-1460(Nov 1974). (In French).

The variation of scintillation yield of deaerated dioxane solutions containing a primary solute (PBD or PPO) and a secondary solute (POPOP) was studied when irradiated by UV or γ rays. The quenching effect of chlorinated compounds (CCl_4 or $CHCl_3$) was measured. The results indicate the contribution of electrons formed by autoionization during solvent-solute 1 energy transfer, a transfer which takes place only from highly excited electronic levels. A kinetic scheme of solvent-solute energy transfer is proposed that is in good agreement with experimental results. (FR)

11565 SELF-POWERED NEUTRON DETECTOR. Goldstein, N. P.; Todt, W. H. (to Westinghouse Electric Corp.). US Patent 3,872,311. 18 Mar 1975. Filed date 5 Jul 1973. 4p.

A self-powered neutron detector is detailed wherein a thin conductive layer of low neutron cross section, high density material is disposed about an emitter core of material which spontaneously emits radiation on neutron capture. The high density material is absorptive of beta radiation emitted by decay of the emitter core activation product, but is substantially transmissive to the high average energy prompt electrons emitted by the emitter core material. (5 claims, 2 drawing figures) (Official Gazette)

11566 THEORETICAL CALCULATION ON THE YIELD FUNCTIONS FOR A NEUTRON MULTIPLICITY ANALYZER. Vinje, J. A.; Arens, M.; Skolnik, J. (Amsterdam Univ.). Planet. Space Sci.; 23: No. 1, 115-121(Jan 1975).

The yield functions for a neutron multiplicity analyzer of a neutron monitor NM-64 have been calculated for the observed multiplicities 1, 2, 3, and 4. The accuracy of these functions, which is limited by the scattering in the mean lifetimes of the neutrons in the monitor, has been given. (auth)

11567 IN-CORE NEUTRON-DETECTOR BEHAVIOUR DURING REACTOR TRANSIENT OPERATION. Boeck, H. (Atominstitut der Oesterreicheschen Hochschulen, Vienna). Nucl. Instrum. Methods; 125: No. 2, 327-329(1 Apr 1975).

The signals of a Co- and a Hf selfpowered neutron detector

were compared with the signal of a miniature in-core fission chamber during fast reactor power transients. (auth)

11568 THIN LAYER NaI(Tl) DETECTORS FOR LOW ENERGY PROTONS. Liaud, P.; Steinberg, R. I.; Vignon, B. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). Nucl. Instrum. Methods; 125: No. 2, 325-326(1 Apr 1975). (In French).

A method is described for fabricating very thin layers of NaI (Tl) – 8000 Å – used as detectors for 20 keV protons. This type of detector has been used in an experiment testing time-reversal invariance in the beta decay of the polarized neutron. (auth)

11569 NEUTRON DETECTION EFFICIENCY OF SILVER COUNTERS. Mayer, F. J.; Brysk, H. (KMS Fusion, Inc., Ann Arbor, Michigan 48106, USA). Nucl. Instrum. Methods; 125: No. 2, 323-324(1 Apr 1975).

The "silver counter" is an uncomplicated fast-neutron detector utilized primarily in controlled thermonuclear research to obtain the total neutron yield from a single intense ($>10^5$ neutrons) short ($<10^{-6}$s) burst by activation of short-lived beta radioactivity in silver. It is used in a standardized design, configuration and mode of operation in order to enhance reproducibility of results among different laboratories. A simple inexpensive technique is described for determining the detection efficiency of a silver counter for pulsed neutrons. (auth)

11570 DETERMINATION OF THE ELECTRIC-FIELD DISTRIBUTION IN COAXIAL Ge(Li) DETECTORS WITH THE HELP OF THE C–V CHARACTERISTIC OF THE DETECTOR. Szymczyk, W. M.; Moszynski, M. (Institute of Nuclear Research, Warsaw (Poland)). Nucl. Instrum. Methods; 125: No. 2, 237-243(1 Apr 1975).

The practically measured capacitance vs voltage (C–V) characteristics of coaxial Ge(Li) detectors show that the compensation of donors and acceptors in the depleted region of the detector is not ideal. Assuming a slightly p-type character of the "intrinsic" region the space-charge distribution and the electric-field distribution can be calculated with the help of the C–V characteristic. In the very often encountered case of the characteristic of the type: straight line in a log-log scale with a plateau for voltages greater than a certain value (U_0), the electric field is shown to fall down near the p-contact of the detector. For voltages below U_0 — analogically to p-n junction detectors — the field at the boundary of the depleted region is equal to zero, and the depleted-region width is dependent on the bias voltage. The type of the postulated electric-field distribution seems to be confirmed qualitatively by the drift theory and timing experiments. (auth)

11571 AN OVERLAPPING MULTICHANNEL DETECTOR SYSTEM. Auer, I. P.; Caplan, H. S.; Hough, J. H.; Bergstrom, J. C.; Kline, F. J.; Hicks, R. S. (Saskatchewan Univ., Saskatoon (Canada). Saskatchewan Accelerator Lab.). Nucl. Instrum. Methods; 125: No. 2, 257-264(1 Apr 1975).

A multichannel system for the detection of medium-energy electrons is described. The system consists of 24 overlapping plastic scintillators which define 45 momentum channels. Fast-logic circuitry is used to process the signals and the data is read into an on-line computer via a buffer memory. The performance is characterized by a high count-rate handling ability, good background rejection and moderate resolution. (auth)

11572 A PROCEDURE FOR ANALYZING THE MULTIPLE NEUTRON READ OUT. Krueger, F. R. (Technische Univ. Darmstadt (F. R. Germany). Inst. fuer Kernphysik). Nucl. Instrum. Methods; 125: No. 2, 285-287(1 Apr 1975). (In German).

A data-analysis method is described which applies to measurements of reactions with multiple neutron numbers in the exit channel. Using the statistical theory of characteristic functions the neutron flux is allowed to be higher compared with methods applied so far. (auth)

11573 THREE-DIMENSIONAL IMAGING WITH A POSITRON CAMERA. Lim, C. B. (Univ. of California, Santa Barbara, CA); Chu, D.; Perez-Mendez, V.; Kaufman, L.; Hattner, R.; Price, D. C. Trans. Am. Nucl. Soc.; 21: 103(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11574 HIGH EFFICIENCY COLLIMATOR-CONVERTERS FOR GAMMA AND NEUTRON IMAGING WITH MWPC. Chu, D. (Univ. of California, Berkeley); Lim, C. B.; Perez-Mendez, V.; Lambert, D.; Kaplan, S. N. Trans. Am. Nucl. Soc.; 21: 113-115(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11575 INEXPENSIVE TRANSVERSE AXIAL SCANNING X-RAY TOMOGRAPHY SYSTEM. Elings, V.; Jensen, G.; Profio, A.; Sherburn, J.; Waidner, J. (Univ. of California, Santa Barbara). Trans. Am. Nucl. Soc.; 21: 115-116(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11576 METHOD FOR THREE-DIMENSIONAL IMAGING AND RECONSTRUCTION. Chang, L. T.; Kaplan, S. N.; Macdonald, B.; Perez-Mendez, V. (Univ. of California, Santa Barbara). Trans. Am. Nucl. Soc.; 21: 116-117(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11577 PULSED ION CHAMBER WIDE-RANGE RADIATION FIELD MONITOR. Ellis, W. H.; Kaiser, B. J. (Univ. of Florida, Gainesville, FL). Trans. Am. Nucl. Soc.; 21: 131-132(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11578 VERSORGUNGSSPANNUNGEN FUER NETZBETRIEBENE STRAHLUNGSMESSGERAETE. (Supply Voltages for Mains Operated Nuclear Instruments). Berlin; Beuth (Jul 1974). 2p. (In German). (DIN-44429).

Standards for the supply voltage of measuring instruments for ionizing radiation are described. (GE)

Radiation Dosimeters

Refer also to abstract 11919.

11579 (CONF-731008-, pp 82-84) SHIFT OF TSEE MAXIMUM AND EXOELECTRON YIELD DURING THE THERMAL TREATMENT OF BeO POWDER. Mlitzke, E. (Physikalisch-Technische Bundesanstalt, Brunswick). 1973.

From 4th international symposium on exoelectron emission and dosimetry; Liblice, Czechoslovakia (1 Oct 1973).

In 4th international symposium on exoelectron emission and dosimetry, Liblice, Czechoslovakia, October 1–3, 1973.

Starting from a temperature of 350°C BeO powder layers were thermally treated up to 1600°C. The exoelectron yield and the temperature of the TSEE maximum increased with the temperature of thermal treatment. The results are discussed as consequence of a desorption process. (auth)

11580 (CONF-731008-, pp 90-92) ENERGY ANALYSIS OF THERMALLY STIMULATED EXOELECTRONS FROM BeO. Peterson, D. D.; Regulla, D. F.; Wachsmann, F. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Munich). 1973.

From 4th international symposium on exoelectron emission and dosimetry; Liblice, Czechoslovakia (1 Oct 1973).

In 4th international symposium on exoelectron emission and dosimetry, Liblice, Czechoslovakia, October 1–3, 1973.

The maximum exoelectron energies of BeO were determined to be 1.5 eV (Brush) and up to several 10 eV (Berylco). The emission mechanism for the high energy exoelectrons is discussed within a space charge model. (auth)

11581 (CONF-731008-, pp 133-136) OSEE FROM SIMPLE AND COMPLEX COMPOUNDS. Holzapfel, G.; Nink, R. (Physikalisch-Technische Bundesanstalt, Berlin). 1973.

From 4th international symposium on exoelectron emission and dosimetry; Liblice, Czechoslovakia (1 Oct 1973).

In 4th international symposium on exoelectron emission and dosimetry, Liblice, Czechoslovakia, October 1–3, 1973.

Starting from a simple compound (CsCl) the OSEE features of complex compounds ($CaSO_4$, BeO, $BaSO_4$, $SrSO_4$) proposed for OSEE dosimetry are investigated. OSEE from CsCl can be explained in detail whereas photoemission from the other materials correlated to TSEE must be discussed by taking into account a variety of selective and nonselective electron transitions combined with spectral dependences of surface and volume properties. (auth)

11582 (CONF-731008-, pp 236-240) APPLICATION OF Li_2O TREATED BeO CERAMICS FOR THE DETECTION OF FAST NEUTRONS IN MIXED RADIATION FIELDS. Kriegseis, W.; Scharmann, A. (Univ., Giessen, Ger.). 1973.

From 4th international symposium on exoelectron emission and dosimetry; Liblice, Czechoslovakia (1 Oct 1973).

In 4th international symposium on exoelectron emission and dosimetry, Liblice, Czechoslovakia, October 1–3, 1973.

In 1970 BECKER and CRASE demonstrated the application of exoelectron emission for the radiation dosimetry in mixed fields of fast neutrons and gamma rays. The technique depends on the generation of recoil protons in an external hydrogeneous radiator. Fast neutron doses can be measured from the TSEE difference of a detector covered with polyethylene or paraffin and another one covered with a hydrogen-free material such as teflon. The latter allows to determine the gamma radiation dose. This method

was tested for ceramic BeO detectors which had been activated by lithium oxide and a pressure treatment. Due to the sensitization an improvement of the lower detection limit can be achieved for gamma rays as well as for fast neutrons. Results are presented and discussed. (auth)

11583 (CONF-731008-, pp 241-243) ABOUT THE ENERGY DEPENDENCE OF THE EXOELECTRON EMISSION OF BERYLLIUM OXIDE IRRADIATED BY PHOTONS. Kriks, H. J.; Siegel, V. (Physikalisch-Technische Bundesanstalt, Brunswick). 1973.

From 4th international symposium on exoelectron emission and dosimetry; Liblice, Czechoslovakia (1 Oct 1973).

In 4th international symposium on exoelectron emission and dosimetry, Liblice, Czechoslovakia, October 1-3, 1973.

The exoelectron emission from BeO can be shown to be proportional to the dose in the surrounding material. An energy dependence of the exoelectron dosemeter occurs only in the case that this material is different from the one the absorbed dose is meant for. Then, the mass energy transfer coefficients of the two materials are to be taken into account which generally depend in a different way on the photon energy. This relation was investigated experimentally in the photon energy range from 20 keV up to 1.25 MeV for 4 different surrounding materials with lower and higher atomic number Z as compared to air. (auth)

11584 (CONF-731008-, pp 244-246) DETERMINATION OF ACTIVATION ENERGIES FROM ISOTHERMAL FADING IN BeO EXOELECTRON DOSIMETERS. Kriks, H. J. (Physikalisch-Technische Bundesanstalt, Brunswick). 1973.

From 4th international symposium on exoelectron emission and dosimetry; Liblice, Czechoslovakia (1 Oct 1973).

In 4th international symposium on exoelectron emission and dosimetry, Liblice, Czechoslovakia, October 1-3, 1973.

Applying the exoelectron effect for dosimetric purposes the fading plays a decisive role, as the storage ability depends more or less on the storage temperature of the exposed dosimeter in relation to the position of the glow maximum. Therefore detailed fading measurements have been performed with BeO at different temperatures. Because of the numerous observed analogies between TSEE and TL the theory of glow curves also can be applied to the exoelectron effect. Based on the kinetic model for the discharge of occupied traps the activation energies can be calculated from the half life experimentally determined at two different but constant temperatures. By means of the activation energies it is then possible to calculate the corresponding frequency factors. (auth)

11585 (CONF-731008-, pp 252-254) SIMULTANEOUS TL AND TSEE MEASUREMENTS ON SOME TLD MATERIALS. Petel, M. (CEA, Fontenay-aux-Roses, France); Holzapfel, G. 1973.

From 4th international symposium on exoelectron emission and dosimetry; Liblice, Czechoslovakia (1 Oct 1973).

In 4th international symposium on exoelectron emission and dosimetry, Liblice, Czechoslovakia, October 1-3, 1973.

Improved correspondence of simultaneous TL and TSEE was achieved from separate samples of the same material (LiF, Al_2O_3) in a two-heater differential device by adding graphite to the TSEE sample. All spectra of chemically identical compounds exhibit nearly coincident TL and TSEE peak locations. The electron traps used in LiF TLD are not created by the dopants (Mg, Ti) and hole processes can be excluded. (auth)

11586 (CONF-731008-, pp 255-257) APPLICATION OF EXOELECTRON EMISSION FOR INTERFACE AND MICRODOSIMETRY. Ennow, K. R. (State Inst. of Radiation Hygiene, Copenhagen). 1973.

From 4th international symposium on exoelectron emission and dosimetry; Liblice, Czechoslovakia (1 Oct 1973).

In 4th international symposium on exoelectron emission and dosimetry, Liblice, Czechoslovakia, October 1-3, 1973.

Dosemeters made from exoelectron emitting material have many advantages which could be used in interfacedosimetry and microdosimetry. Measurements of dose distributions at interfaces and preparation for measurements of the variance of energy deposition are going on. Details of the instrumentation and results of the measurements are given. (auth)

11587 (CONF-731008-, pp 258-260) FAST-NEUTRON DOSIMETRY USING F CENTERS IN MgO. Ritz, V. H.; Nash, A. E.; Attix, F. H. (Naval Research Lab., Washington, DC). 1973.

From 4th international symposium on exoelectron emission and dosimetry; Liblice, Czechoslovakia (1 Oct 1973).

In 4th international symposium on exoelectron emission and dosimetry, Liblice, Czechoslovakia, October 1-3, 1973.

A major shortcoming of presently available fast-neutron dosimeters is their low response per tissue rad to fast neutrons, S_n, in comparison with their corresponding γ-ray response, S_γ. Typically $S_n/S_\gamma = 0.1$. A fast-neutron dosimeter is described, the operation of which is based on the detection of F centers produced in MgO by displacement collisions. The F-center production rate is greatly enhanced by hydrogenous surroundings from which recoil protons are ejected. The absorbed dose is measured by means of the 350°C exoelectron emission peak. The response is linear from 10 to 1000 rad (tissue). $S_n/S_\gamma \approx 0.90$ with hydrogenous surroundings and is independent of neutron energy (±10%) between 2 and 15 MeV. $S_n/S_\gamma \approx 0.06$ without hydrogenous surroundings. Very little fading of the stored signal is observed, but the radiation sensitivity decreases by about 25% per month over a period of two months. A peak at 440°C offers the possibility of increasing the sensitivity of the system. (auth)

11588 (CONF-731008-, pp 261-266) FURTHER STUDIES ON TSEE IN MULTISCALER AND PULSE HEIGHT ANALYZER MODES. Moreno y Moreno, A. (Universidad Nacional Autonoma de Mexico, Mexico City). 1973.

From 4th international symposium on exoelectron emission and dosimetry; Liblice, Czechoslovakia (1 Oct 1973).

In 4th international symposium on exoelectron emission and dosimetry, Liblice, Czechoslovakia, October 1-3, 1973.

The advantages related to flexibility, recording and digitalization of data when using a multichannel analyzer operated in both the multiscaler and pulse height analyzer modes, are pointed out. (auth)

11589 CALORIMETRY IN NUCLEAR PHYSICS. Chatelet, J. (Conservatoire National des Arts et Metiers (CNAM), 75-Paris (France). Lab. National d'Essais). pp 53-77 of Summer School on Calorimetry. Villeurbanne, 13-17 September 1971. Vol. 2. Applications. Villeurbanne, France; Institut de Recherches sur la Catalyse ([nd]). (In French).

From summer school on calorimetry; Villeurbanne, France (13 Sep 1971).

The methods used in nuclear physics and the various types of apparatus built at the National Test Laboratory are described. Three groups of calorimetric techniques are defined: calorimetry of radioactive sources, calorimetry of beams and absorbed doses and calorimetry in nuclear reactors. (FR)

11590 OPERATION, DESCRIPTION AND APPLICATIONS OF THE M.C.B. MINIATURIZED DIFFERENTIAL MICROCALORIMETER. Barberi, P. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Service des Etudes de Physico-Chimie des Procedes). pp 29-73 of Summer School on Calorimetry. Villeurbanne, 24-29 September 1973. Workshop. Villeurbanne, France; Institut de Recherches sur la catalyse ([nd]). (In French).

From summer school on calorimetry; Villeurbanne, France (24 Sep 1973).

A description of the calorimeter is followed by some examples of application: changes of state, heats of dissolution, solid-gas and liquid-gas reactions, calibration of a radioactive source, low-temperature reactions, specific heats. The different factors on which calorimetric measurements depend are reviewed: calibration, thermoregulation, measurement equipment, purity of samples and post-reaction tests. (FR)

11591 THERMOLUMINESCENT ORGANIC PHOSPHORS FOR NEUTRON AND GAMMA DOSIMETRY. Morris, B. M.; Pickard, P. S. (Univ. of Illinois, Urbana). Trans. Am. Nucl. Soc.; 21: 540-541(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11592 NEUTRON ENVIRONMENT AND ITS MEASUREMENT. (International Atomic Energy Agency, Vienna). pp 79-91 of Neutron Irradiation Embrittlement of Reactor Pressure Vessel Steels. Steele, L. E. Vienna; International Atomic Energy Agency (1975).

See STI/DOC-10/163.

Measurement of the damaging capacity of neutrons must be done accurately so that projections of vessel embrittlement can be valid. The following steps are involved: determine the component of concern; identify the metal property degraded by irradiation; calculate neutron flux and spectrum; validate with multiple activation foils; weighting of neutron energy groups; measure property changes in specimens; establish and refine the damage function. (DLC)

11593 MEASURING ELEMENT FOR THE DETECTION AND DETERMINATION OF RADIATION DOSES OF GAMMA RADIATION AND NEUTRONS. Jahn, W.; Piesch, E. (to Gesellschaft fuer Kernforschung mbH). US Patent 3,885,159. 20 May 1975. Priority date 20 Jun 1972, F. R. Germany. 4p.

A measuring element detects and proves both gamma and neu-

tron radiation. The element includes a photoluminescent material which stores gamma radiation and particles of arsenic and phosphorus embedded in the photoluminescent material for detecting neutron radiation. (Official Gazette)

11594 IONIZATION CHAMBER. Jilbert, P. H. (to National Research Development Corp.). US Patent 3,884,817. 20 May 1975. Priority Date 11 Aug 1971, United Kingdom of Great Britain and Northern Ireland. 4p.

The invention concerns ionization chambers with particular reference to air-equivalent ionization chambers. In order to ensure that similar chambers have similar sensitivities and responses the surface of the chamber bounding the active volume carries a conducting material, which may be a colloidal graphite, arranged in the form of lines so that the area of the conducting material occupies only a small proportion of the area of said surface. (Official Gazette)

11595 EFFICIENCY OF ^{7}LiF THERMOLUMINESCENT DOSIMETERS FOR MEASURING 250 MeV/AMU $^{6+}$C IONS. Patrick, J. W.; Stephens, L. D.; Thomas, R. H.; Kelly, L. S. (Univ. of California, Berkeley). Health Phys.; 28: No. 5, 615-617(May 1975).

A determination of the efficiency, relative to ^{60}Co γ-rays, of ^{7}LiF thermoluminescent dosimeters measuring 250 MeV/amu $^{6+}$C ions, is reported. The value obtained of 0.89 ± 0.04, at LET in LiF of 11.6 keV/μm, is shown to be in good agreement with previously reported theoretical values. (UK)

Nuclear Spectroscopic Instrumentation

Refer also to abstracts 12241 and 12243.

11596 (TID/SNG-12) SUPPLEMENT TO SCIENCE INSTRUMENT RADIATION SENSITIVITY REPORT NUMBER 1, VOYAGER TASK C. Matteo, D.; Peden, J.; Roberts, D. (General Electric Co., Philadelphia, Pa. (USA). Missile and Space Div.). 1 Jun 1967. 19p. Dep. NTIS $4.00.

For Jet Propulsion Lab., Pasadena, CA.

Estimates are presented of shielding and deployment distance requirements needed to accommodate radiation detection instruments in an RTG-powered Voyager spacecraft. (LCL)

11597 SPECTRUM MEASUREMENTS IN THE FAST NEUTRON SPECTRUM STANDARD NISUS WITH LITHIUM-6 SANDWICH SPECTROMETERS. Koutzoukos, G.; Besant, C. B. (Imperial Coll. of Science and Tech., London). J. Brit. Nucl. Energy Soc.; 14: No. 1, 83-88(Jan 1975).

Improvements in differential cross section data are required in order that important parameters, such as reactivity, may be predicted with sufficient accuracy for fast breeder reactors. This often necessitates the accurate measurement of neutron spectra and integral reaction rates in zero energy fast reactors in order to check the differential data and adjust it if required. The use of the lithium-6 semiconductor detector for neutron spectrum measurements is discussed, with details of the technique such as the triton unfolding and the dependence on the angular cross section of ^{6}Li. Spectrum measurements have been made in the fast neutron spectrum generator NISUS and the results have been compared with calculations using the discrete ordinate code ANISN. The ^{6}Li results are also compared with results obtained from proton recoil spectrometer measurements. The comparisons show that the ^{6}Li technique gives good agreement with theory in the energy range 500 keV to 7 MeV. In this energy region, the ^{6}Li technique is based on the sum method of adding alpha and triton energies. A small discrepancy was observed at an energy of 2 MeV, which is thought to be due to possible errors in the ^{238}uranium inelastic scattering cross section data. The ^{6}Li results below 500 keV which were obtained by the triton unfolding method are not in such good agreement with theory as the proton recoil results, the discrepancies being largest at low energies (10 keV). (auth)

11598 FITTING OF GAUSSIAN TO PEAKS BY NON-ITERATIVE METHOD. Mukoyama, T. (Kyoto Univ., Uji (Japan). Inst. for Chemical Research). Nucl. Instrum. Methods; 125: No. 2, 289-291(1 Apr 1975).

A method for fitting a Gaussian spectrum without iterative procedure is presented. The method utilizes a linearization technique of the Gaussian function and the standard linear least-squares fitting. Experimental and pseudo-experimental peaks have been used to test this method and a comparison with the conventional non-linear least-squares method has been made. The present method has the advantages of not requiring the initial estimates of Gaussian parameters, and not requiring large computer memory. (auth)

11599 AN EXTREMELY LOW-LEVEL X-RAY SPECTROMETER. Takahashi, H.; Mabuchi, H.; Hamaguchi, H. (Tokyo Univ. (Japan). Faculty of Science); Shimokoshi, F. Tokyo Univ. (Japan). Dept. of Physics). Nucl. Instrum. Methods; 125: No. 2, 293-299 (1 Apr 1975).

An extremely low-level X-ray counter system has been constructed with heavy-mass and anticoincidence shieldings. The detector is made of oxygen-free copper and is of cylindrical form. It operates as a proportional counter of the gas-flow type (argon-methane), inside of which are placed the samples. It is surrounded by 7 mm thick purified mercury, multiwire GM anticoincidence counters, 1 cm thick oxygen-free copper, 12 cm thick iron, and finally 10 cm lead. The whole assembly is built in an underground cell heavily shielded from major cosmic ray components with a rock cover of at least 100 mwe. After careful measurements of the background counting rate, it was found that oxygen-free copper still contains some radioactive impurities, constituting a considerable portion of background count. By coating the inside wall of sample holders with purified nickel or copper, the background counting rate was reduced to a great extent. The definitive background counting rate is 0.1 cpm/keV in the energy region of 4-5 keV for 940 cm^{2} of sample area (2π geometry). (auth)

11600 PULSE-HEIGHT RESOLUTION OF THIN SCINTILLATOR FOILS. Batsch, T. (Warsaw Univ. (Poland). Instytut Fizyki Doswiadczalnej); Moszynski, M. (Institute of Nuclear Research, Warsaw (Poland)). Nucl. Instrum. Methods; 125: No. 2, 231-236(1 Apr 1975).

Pulse-height resolution of thin scintillator foils prepared from plastic scintillators NE 111 and NE 102A was experimentally tested. Since the intrinsic energy resolution was not observed it was found that the over-all resolution of the detector is due to the properties of the photomultiplier only. From the discussion of the dependence of energy resolution on foil thickness and mean number of photoelectrons released per scintillation it was concluded that this phenomenon can be related to the good optical properties of scintillator foils and their unusual optical coupling to the photomultiplier tube face, but not to the mechanism of light generation. (auth)

11601 AN INTER-COMPARISON OF EFFICIENCY-CALIBRATION TECHNIQUES FOR SEMICONDUCTOR X-RAY DETECTORS. Campbell, J. L.; McNelles, L. A. (Geulph Univ., Ontario (Canada). Dept. of Physics) Nucl. Instrum. Methods; 125: No. 2, 205-223(1 Apr 1975).

A critical review is given of several methods for construction of efficiency curves for Si(Li) and Ge(Li) detectors in the energy region 5 to 130 keV. Atomic and nuclear data for the x/γ-ratio method are revised. Efficiency curves constructed by this method and a method involving a thin NaI(T1) detector are found to be in good agreement. These two widely used methods afford precision between 2 and 5%, and it is concluded that if smaller error limits are required in photon-intensity determinations, 4π counting techniques are necessary. (auth)

11602 EXPRESSION FOR GAS MULTIPLICATION IN ^{3}He PROPORTIONAL COUNTERS Hopstone, P.; Shalev, S. (Israel Inst. of Tech., Haifa). Trans. Am. Nucl. Soc.; 21: 132-133(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11603 MULTIPLE SCATTERING NEUTRON COINCIDENCE SPECTROMETER. Folk, K. S. Jr. (General Electric Co., San Jose, CA); Carroll, E. E. Jr. Trans. Am. Nucl. Soc.; 21: 503-504(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11604 DEVELOPMENT AND STANDARDIZATION OF AN NE-213 FAST-NEUTRON SPECTROMETER SYSTEM. Meyer, W.; Miller, W. H. (Univ. of Missouri, Columbia). Trans. Am. Nucl. Soc.; 21: 535-536(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11605 MULTIREACTION ACTIVATION DETECTORS FOR HADRON AND REACTOR NEUTRON SPECTROSCOPY. Routti, J. T. (Helsinki Univ. of Tech., Otaniemi, Finland). Trans. Am. Nucl. Soc.; 21: 539-540(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11606 TIME-OF-FLIGHT SPECTROMETER OF COLD NEUTRONS. Sirota, N. N.; Bulat, I. A.; Pashkovskii, Yu. L.; Smolik, Ch. K. (Inst. of Solid State Physics and Semiconductors, Minsk).

Vestsi Akad. Navuk BSSR, Ser. Fiz.-Mat. Navuk; No. 2, 64-68 (1975). (In Russian).

A time-of-flight spectrometer is described with a mechanical chopper-monochromator, which is used for studying inelastic dispersion of cold neutrons in the condensed phases. The monochromator allows, for changes in the revolution rate of from 6 to 9×10^3 rpm, isolating the monochromatic line of the neutrons in the 4- to 6-Å range. Here $\Delta E_0/E_0$ 22% for E_0 = 0.005 eV. The results of measurements of the basic characteristics of the spectrometer are compared with the corresponding values of existing apparatus of this type. (tr-auth)

High Energy Physics Instrumentation

Refer also to abstract 12619.

11607 A LEAD-GLASS CHERENKOV DETECTOR FOR ELECTRONS IN THE 100 MeV REGION. Czapek, G.; Haenni, H.; Markees, A.; Schacher, J.; Viertel, G. (Bern Univ. (Switzerland)). Nucl. Instrum. Methods; 125: No. 1, 41-44(15 Mar 1975).

A total-absorption lead-glass Cherenkov detector was tested with electrons in the energy range from 50 to 200 MeV. An energy resolution of 37% (fwhm) at 100 MeV has been found. (auth)

11608 A VERTEX DETECTOR WITH MULTIGAP PROPORTIONAL CHAMBERS. Bouclier, R.; Brown, R. C. A.; Chesi, E.; Dumps, L.; Fischer, H. G.; Innocenti, P. G.; Maurin, G.; Minten, A.; Naumann, L.; Piuz, F. (European Organization for Nuclear Research, Geneva (Switzerland)). Nucl. Instrum. Methods; 125: No. 1, 19-24(15 Mar 1975).

A multiparticle spectrometer at the CERN Intersecting Storage Rings is equipped with proportional chambers as detectors. The design and performance of the vertex detector around the collision region are described. The detector consists of ~20,000 proportional wires in densely packed chambers. (auth)

11609 A NEW SINGLE-WIRE READOUT SYSTEM FOR SPARK CHAMBERS. Jensen, H. B.; Marshall, M.; Pine, J. (California Inst. of Tech., Pasadena (USA)). Nucl. Instrum. Methods; 125: No. 1, 25-28(15 Mar 1975).

An individual wire readout system has been designed and built for use in a 10,000 wire cylindrical spark-chamber assembly. The spark chambers are located around the 1 meter long liquid-hydrogen target of LASS, the Large Aperture Solenoid Spectrometer at the Stanford Linear Accelerator Center, in a 25 kG magnetic field. This location leads to requirements of high reliability and small physical size of the readout electronics. In addition, to insure good multispark efficiency in the region of high spark density close to the target, a narrow spark width, preferably over a wide plateau in high voltage, is required. This has been achieved by limiting the voltage difference between adjacent wires due to a spark on one of them to ≤100 V. (auth)

11610 A DIGITISED NEON FLASH-TUBE CHAMBER FOR γ-RAY DETECTION. Chaney, J. E.; Breare, J. M.; Tait, I. D. (Durham Univ. (UK)). Nucl. Instrum. Methods; 125: No. 1, 189-196(15 Mar 1975).

A technique using flash tubes for detecting γ rays is described, in which the energy, direction, and position of the γ rays can all be obtained. The suitability of flash tubes for electron-shower detection results from the use of poorly conducting glass as the tube material. Its high resistance limits the current flowing in a tube so that all the available energy is not taken by any one tube. A chamber consisting of 8 modules, having a total of 128 tubes, was digitized, using small probes on the end of each tube. The output from the probes was fed, without amplification, along cables to CAMAC. Between each module, 1 or 2 radiation lengths of lead were placed. Tests have been carried out with an electron beam in the energy range 0.5 to 4 GeV. From measurement of the number and position of the tubes which ignited it was found that the energy of the primary electron could be estimated to ±18% at 1 GeV. From the same measurements estimates of the shower apex and axis can be made. The position of the apex can be obtained to about ±1 cm using tubes of diameter 1.6 cm. The direction of the shower axis can be measured to better than ±2°. (auth)

11611 SELF-SHUNTED STREAMER CHAMBER. Balestra, F.; Busso, L.; Garfagnini, R.; Perno, G.; Piragino, G. (Turin Univ. (Italy). Istituto di Fisica); Barbini, R.; Guaraldo, C.; Scrimaglio, R. (Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati); Falomkin, I. V.; Kulyukin, M. M. Nucl. Instrum. Methods; 125: No. 1, 157-168(15 Mar 1975).

The self-shunted streamer chambers can be used as visualizers of particle tracks and as detectors of event vertices. The operating conditions of this type of chamber in the presence of a magnetic field, and the features of the hv-pulse generator connected to the chamber are discussed. The results in the precision which can be obtained in the reconstruction of the tracks are discussed. (auth)

11612 A NEW DETECTOR OF CHARGED PARTICLES: A DISCHARGE DIFFUSION CLOUD CHAMBER. Barnaveli, T. T.; Grigalashvili, N. S.; Javrishvili, A. K.; Manjavidze, Z. Sh. (Institute of Physics, Academy of Sciences of the Georgian SSR, Tbilissi, USSR). Nucl. Instrum. Methods; 125: No. 1, 89-91(15 Mar 1975).

A new detector of charged particles, a discharge diffusion cloud chamber is described. The characteristics of this device are given. Photographs of charged-particle tracks of cosmic rays were obtained in this chamber. (auth)

11613 A NEW TYPE OF CERENKOV RADIATORS CONSTITUTED OF SILICA AEROGELS. Cantin, M.; Casse, M.; Koch, L.; Jouan, R.; Mestreau, P.; Roussel, D. (CEA Centre d'Etudes Nucleaires de Saclay, 90-Gif-sur-Yvette (France). Service d'Electronique Physique); Bonnin, F.; Moutel, J.; Jean-Teichner, S.; (Lyon-1 Univ., 69-Villeurbanne (France)). J. Chim. Phys.; 71: No. 11, 1537-1540(Nov 1974). (In French).

Silica aerogels prepared in the conditions described, constitute relatively compact transparent solids, their refractive index depending on the apparent density. The initial refractive index, between 1.01 and 1.06, can be increased by a thermal treatment of the aerogel which does not destroy its transparency. The use of these aerogels as Cherenkov radiators, instead of gas under pressure, allows the difficulties due to pressure enclosures to be eliminated. (FR)

11614 EXPERIMENTAL SET-UP FOR THE STUDY OF ELASTIC π^-p SCATTERING AT SMALL ANGLES FOR ENERGIES OF 40 AND 50 GeV. Adylov, G. T.; Aliev, F. K.; Filippov, P. I.; Gajewski, W.; Guzik, Z.; Ioan, I.; Krasowski, R.; Nigmanov, T. S.; Peshekhonov, V. D.; Popielski, W. (Joint Inst. for Nuclear Research, Dubna (USSR)). Nucl. Instrum. Methods; 125: No. 2, 301-306(1 Apr 1975).

An experiment was carried out at the accelerator of the Institute for High Energy Physics (Serpukhov) with the aim of investigating the elastic scattering of π^-mesons on protons, with incident pion momenta equal to 40 and 50 GeV/c. The experiment was performed using a magnetic spectrometer with magnetostrictive spark chambers. Elastic interactions were identified with the help of the momentum measurements of the scattered π^-meson. The four-momentum transfer was determined from the scattering angle in the target. The obtained experimental data allow the determination of the slope of the differential cross section as a function of the four-momentum transfer t. In the region of small t, by taking into account the interference of the amplitudes of elastic and Coulomb scattering, it is possible to determine the ratio of the real and imaginary parts of the elastic scattering amplitude. The determination of these two parameters is important for verification of existing predictions about their asymptotic behaviour. (auth)

11615 COMMENTS ON POSSIBLE CRYOGENIC-GAS CHERENKOV SYSTEMS. Spillantini, P. (Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati). Nucl. Instrum. Methods; 125: No. 2, 319-320 (1 Apr 1975).

Large-solid-angle Cherenkov counters using low-temperature instead of high-pressure gases could be useful to achieve full π/K separation over the momentum range up to a few GeV/c. (auth)

11616 HIGH-ACCURACY BI-DIMENSIONAL DRIFT CHAMBERS. Breskin, A.; Charpak, G.; Sauli, F. (European Organization for Nuclear Research, Geneva (Switzerland)). Nucl. Instrum. Methods; 125: No. 2, 321-322(1 Apr 1975).

Drift chambers of moderate size, with a delay-line readout of the position of the avalanche, give the position of soft radiations with the same accuracy in all directions: 0.4 mm (fwhm). (auth)

11617 PERFORMANCE OF LARGE IRON-PLASTIC IONIZATION SPECTROMETER. Amburgey, J. D.; Gabriel, R. A. (Oak Ridge National Lab., TN). Trans. Am Nucl. Soc.; 21: 541-542 (Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

Radiometric Instruments

Refer also to abstract 11550.

11618 CARBON/OXYGEN (C/O) LOGGING INSTRUMENTATION. Culver, R. B.; Hopkinson, E. C.; Youmans, A. H. (Dresser Industries, Houston, TX). Soc. Pet. Eng. J.; 14: No. 5, 463-470 (Oct 1974).

From 48th annual fall meeting of SPE–AIME; Las Vegas, NV (30 Sep 1973).

An instrument system has been developed for field measurement of the relative carbon content of reservoir rocks. Gamma rays produced by inelastic scattering of 14-MeV neutrons are detected and analyzed in a sophisticated scintillation spectrometer system adapted for routine commercial well logging. A pulsed-neutron source similar to those in commercial use for other nuclear logs is employed. A van de Graaff generator provides the accelerating voltage to initiate the deuterium-tritium reaction, which produces the neutrons in a specially designed ion acceleration tube. Pulses from the radiation detector are transmitted to the surface over a conventional seven-conductor logging cable without degrading the spectrum. The log is available on a limited commercial basis and is recommended for identifying oil-saturated zones in cased wells where formation water is too fresh for reliable application of the Neutron Lifetime Log. (auth)

11619 NUCLEONIC TECHNIQUES FOR ON-LINE ANALYSIS AND CONTROL IN THE MINERAL PROCESSING INDUSTRY. Berry, P. F. (Texas Nuclear Corp., Austin). Trans. Am. Nucl. Soc.; 21: 137-138(Jun 1973).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11620 MULTIPLE-SOURCE, MULTIELEMENT NEUTRON TECHNIQUES FOR PROCESS AND PRODUCT ANALYSIS. Taylor, M. C. (Columbia Scientific Industries, Austin). Trans. Am. Nucl. Soc.; 21: 137-138(Jun 1973).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11621 STATUS OF PORTABLE X-RAY METHODS AND APPLICATIONS IN MINERAL ASSAY. Rhodes, J. R. (Columbia Scientific Industries, Austin). Trans. Am. Nucl. Soc.; 21: 138-139(Jun 1973).

From transactions of the American Nuclear Soceity 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11622 NUCLEAR WELL LOGGING. Hilchie, D. W. (Colorado School of Mines, Golden, CO). Trans. Am. Nucl. Soc.; 21: 139(Jun 1973).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11623 PULSED-NEUTRON LOGGING FOR IN-SITU ASSAY OF URANIUM BOREHOLES. Jensen, D. H. (Sandia Labs., Albuquerque, NM). Trans. Am. Nucl. Soc.; 21: 151-152(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11624 NEUTRON AND GAMMA GAUGES: THEIR DESIGN AND APPLICATION. Oelgaard, P. L. (Technical Univ. of Denmark, Lyngby). pp 147-166 of Radiation Engineering in the Academic Curriculum. Vienna; International Atomic Energy Agency (1975).

From proceedings of a study group on radiation engineering in the academic curriculum; Haifa, Israel (27 Aug 1973). See STI/PUB-372; CONF-730866-.

A number of gauges based on nuclear principles are at present in use in industry. Significant differences exist between those gauges that use charged particles and those that use neutron and gamma quanta. Neutrons and gamma radiation have, in most cases, much longer ranges than charged particles and therefore yield information on the properties of much larger volumes of matter. The paper discusses the physical concepts necessary in the design and use of various types of gauges, the types of nuclear interaction between matter and neutrons or gamma quanta and suggests some of the applications that have been made of nuclear gauges. (auth)

11625 ALPHA-PARTICLE GAUGES. Gardner, R. P.; Verghese, K. (North Carolina State Univ., Raleigh). pp 167-183 of Radiation Engineering in the Academic Curriculum. Vienna; International Atomic Energy Agency (1975).

From proceedings of a study group on radiation engineering in the academic curriculum; Haifa, Israel (27 Aug 1973). See STI/PUB-372; CONF-730866-.

Recent advances in both detector and source technology have increased interest in the use of alpha particles for gauging. A brief history of the field is given together with a number of select references. The principles and applications are reviewed and an analytical model for an alpha-particle gauge is briefly discussed. An experimental verification of the model is presented. (auth)

11626 NUCLEAR GAUGES IN THE AUTOMATION OF INDUSTRY. Huber, H. (Landis and Gyr AG, Zug, Switzerland). pp 185-207 of Radiation Engineering in the Academic Curriculum. Vienna; International Atomic Energy Agency (1975).

From proceedings of a study group on radiation engineering in the academic curriculum; Haifa, Israel (27 Aug 1973). See STI/PUB-372; CONF-730866-.

Based on the general laws of interaction with matter, some common aspects of nuclear gauging are developed. These common aspects include the outlay of nuclear gauges and the geometrical arrangement of radiation source and detector together with the correlation of interaction laws and type of radiation used in the different nuclear gauges. After dealing with the specific qualities of level, density, thickness and moisture gauges, typical applications of these gauges in various industries are described. Questions as to the choice of radiation sources and detectors, methods of calculation of activities and evaluation of accuracies are treated in an appendix. (auth)

11627 APPLICATIONS OF RADIOISOTOPES IN X-RAY SPECTROGRAPHY. Campbell, W. J. (Bureau of Mines, College Park, MD). pp 225-258 of Radiation Engineering in the Academic Curriculum. Vienna; International Atomic Energy Agency (1975).

From proceedings of a study group on radiation engineering in the academic curriculum; Haifa, Israel (27 Aug 1973). See STI/PUB-372; CONF-730866-.

Energy dispersion x-ray analysis using β, γ, and x-ray emitting isotopes as the excitation source is an important extension of applied x-ray spectrography. Because of the low flux from the radioisotopic sources, x-ray resolution is acieved by physical or electronic discrimination as contrasted to Bragg diffraction in conventional x-ray spectrography where the flux from the x-ray tube is 10^6 greater. Although the x-ray spectrograph employing wavelength dispersion is generally superior in the laboratory, there are many industrial control, mining and environmental monitoring applications for energy dispersion systems. The compact low-cost units based on balanced filters for energy resolution are employed for a variety of single-element determination problems. High-resolution semiconductor detectors used with dedicated or time-sharing computers are becoming very important for rapid multielement analysis such as air-pollution monitoring. Applications discussed include identification of scrap metals, measurement of coating thickness and composition, analysis of mining samples including in situ analysis down a drill hole, and determination of trace elements of environmental concern. For some of the trace element studies radioisotopes are employed as the excitation source and as a collection monitor. (auth)

11628 RADIATION SAFETY AS RELATED TO RADIOISOTOPE INSTRUMENTS. Cameron, J. F. (Nuclear Enterprises Ltd., Reading, Eng.). pp 259-268 of Radiation Engineering in the Academic Curriculum. Vienna; International Atomic Energy Agency (1975).

From proceedings of a study group on radiation engineering in the academic curriculum; Haifa, Israel (27 Aug 1973). See STI/PUB-372; CONF-730866-.

Radiation safety as related to radioisotope instruments is of interest to international organizations, national bodies including governments, instrument manufacturers and users. It is a continuing subject for research, and appropriate instruction has to be given to a wide category of people varying from university professors to machine operators. The paper reviews relevant international recommendations and national legislation and details practical methods adopted by instrument manufacturers and users to ensure the continuous safe operations of on-line, laboratory and field instruments by the wide variety of users. Safety is achieved by care in source selection and containment, good design of radiation shields, collimators, barriers and source-detector geometry, and the use of minimum source activity accomplished by incorporating high-efficiency radiation detectors and stable, sensitive electronics. (auth)

11629 SOME EXPERIENCE IN TEACHING NUCLEAR TECHNIQUES AND A NEW CONCEPT OF THEIR INCORPORATION INTO ACADEMIC CURRICULA. Korbel, K. (Inst. of Nuclear Physics, Cracow, Poland). pp 269-283 of Radiation Engineering in the Academic Curriculum. Vienna; International Atomic Energy Agency (1975).

From proceedings of study group on radiation engineering in the academic curriculum; Haifa, Israel (17 Aug 1973). See STI/PUB-372; CONF-730866-.

The rapid improvement in nuclear techniques and their wide applicability create a special problem in their introduction into industrial practice. Experience gained since 1956 in teaching radiation engineering at the University of Mining and Metallurgy in Cracow is presented and discussed. The experience gained has led to a new approach focussed on inclusion of material on nuclear techniques in the syllabi of the various faculties. Such material is directly relevant to the fields of principal instruction and the approach has proved successful thus far. Two sets of

instructions for laboratory experiments illustrative of the approach to provide industrial-type experience are included in an appendix. (auth)

Radiation Effects on Instrument Components, Instruments, or Electronic Systems

Refer also to abstracts 11940 and 12151.

11630 STUDY ON THE ETCHING PROPERTIES OF ELECTRON-IRRADIATED PLASTIC TRACK DETECTORS. Schlenk, B.; Somogyi, G.; Valek, A. (Magyar Tudomanyos Akademia Atonmag Kutato Intezete, Debrecen, Hungary). Radiat. Eff.; 24: No. 4, 247-253(Mar 1975).

The variations of the bulk etching rate of electron-bombarded CN, CA, CAB, PC, and PET sheets were studied as a function of electron dose and etching temperature. A conclusion was made that in the plastics under study a radiation-damaged region produced, either by an electron beam or a heavily ionizing nuclear particle display, to a certain extent, analogous etching properties. It was shown that the ratio of the etching rates of an electron-bombarded and an unirradiated sheet increases with the increase of the etching temperature for PC and PET, and with the decrease of etching temperature for CN and CA. Similar temperature dependences were obtained for the ratio of track- and bulk-etching rates (i.e., for registration sensitivity) if the plastic sheets were irradiated with heavier nuclear particles. The results seem to confirm the assumption that the delta electrons may play an important role in the formation of primary nuclear particle tracks in plastic track detectors. (auth)

Miscellaneous Instruments

Refer also to abstracts 12076, 13236, and 13248.

11631 (TID/SNA-1430) DEVELOPMENT OF A QUALITY DETECTOR FOR TWO-PHASE FLUID SYSTEMS. Monteith, D. O. Jr. (Aerojet Liquid Rocket Co., Sacramento, Calif. (USA)). 17 Feb 1964. 29p. Dep. NTIS $4.50.

When a fluid is in the boiling region, temperature and pressure are not independent variables, and another parameter, such as density or quality, is required to define the system. The ratio of the gas weight to the total weight is known as the quality, Q, of the mixture. The quality can be determined if the density of the liquid and gas are known and if the density of the mixture can be measured. In many instances, for nonconducting two phase systems, it is more convenient to measure another property from which the density can be determined (e.g., dielectric constant and the Clausius-Mossotti relationship). Such a technique for determining the quality of a two-phase system is described. The technique is illustrated by the design of a prototype hydrogen quality detector. This unit can be modified to measure the quality of other cryogenic fluids by replacing three plug-in modules designed to the properties of the fluid. The distinguishing feature of this system is that its ability to detect quality near the critical point is limited only by the accuracy with which the density of the fluid mixture can be measured. (auth)

11632 A TWO-COIL SPIN FLIPPER FOR BEAMS OF POLARIZED SLOW NEUTRONS. Liaud, P.; Steinberg, R. I.; Vignon, B. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). Nucl. Instrum. Methods; 125: No. 1, 7-8(15 Mar 1975).

A simple device for flipping the spins of non-monochromatic polarized slow neutron beams is described. The advantage of this device is that it does not require the introduction of any material into the beam and thus eliminates a possible source of capture-gamma radiation and small-angle neutron scattering. The flipping efficiency for a beam of cold neutrons (mean velocity ~1100 m/s) is 97%. (auth)

11633 USE OF A BENT PACKET OF PERFECT CRYSTAL LAMELLAE AS FOCUSING NEUTRON MONOCHROMATOR. Frey, F. (Muenchen Univ. (F. R. Germany)). Nucl. Instrum. Methods; 125: No. 1, 9-17(15 Mar 1975).

The first prototype of a neutron monochromator, consisting of bent perfect Si lamellae, is used on a neutron diffractometer at the FRM. The properties in real and momentum space were studied and experimental results discussed. The characteristics of the bent packet are briefly compared with other new methods using bent crystals. (auth)

11634 TIME-ZERO INDICATOR FOR EXTERNALLY PULSED ION BEAMS INDEPENDENT OF THE PULSE CHARGE AND ITS FLUCTUATIONS. Gerlich, R.; Kornahl, W.; Richter, F. W. (Marburg Univ. (F. R. Germany). Fachbereich Physik). Nucl. Instrum. Methods; 125: No. 1, 1-5(15 Mar 1975). (In German).

Applications of the pulsed-ion-beam technique for the measurement of decay times of excited nuclear states or the measurement of time of flight of particles require a quite accurate knowledge of the incidence time of the charge center of the ion pulse on the target (time-zero indicator). To reach accuracies better than about 1 ns with time-zero indicators, the usual application of time-pick-off systems using the influence or induction method is inadequate in most cases because of the small total charge content of the ion pulse or pulse-to-pulse charge fluctuations. The present work deals with a method generating time-zero-signals free from these problems and which can be used with external pulse systems. In particular, a method is reported to obtain time-zero signals from the sinusoidal 30 MHz deflection voltage of an external pulse system which runs synchronously with the 1 MHz pulse sequence of an internally pulsed accelerator. (auth)

11635 DESIGN, CONSTRUCTION AND TESTING OF A NEW TYPE OF "STERN-GERLACH" POLARIZER OR ANALYZER OF NEUTRON POLARIZATION. Hamelin, B. (Institut Max von Laue–Paul Langevin, 38–Grenoble (France)); Xiromeritis, N.; Liaud, P. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). Nucl. Instrum. Methods; 125: No. 1, 79-84(15 Mar 1975). (In French).

Several kinds of Stern-Gerlach apparatus have been built and tested as analyzers of neutron polarization. The inherent disadvantages of the "classical Stern-Gerlach magnet" have been minimized. With reasonable care, it is possible to reach an accuracy better than 1% for a cold-neutron spectrum. (auth)

11636 DEADTIME LOSS IN SOFTWARE-CONTROLLED PULSE-HEIGHT ANALYZERS. Porges, K. G. A. (Argonne National Lab., Ill. (USA)). Nucl. Instrum. Methods; 125: No. 1, 125-132(15 Mar 1975).

Deadtime losses arising in the ADC as well as in the on-line computer are examined for a number of different systems incorporating buffer interfacing with one or more words capacity. Analog derandomizers, multiplexed channels and applications in time-interval acquisitions are briefly discussed. Formula and plots are provided to facilitate the choice among different systems and programs for a given input rate and ADC bit number, or to adjust the input rate so as to collect counting data most effectively, given a certain required resolution and program. (auth)

11637 TECHNICAL AND ECONOMICAL MANAGEMENT OF A STOCK OF ELECTRIC MEASURING INSTRUMENTS. Maintenance Policy: The Actual Case of the Saclay Nuclear Research Center. Guyot, C. (CEA Centre d'Etudes Nucleaires de Saclay, 91–Gif-sur-Yvette (France). Services d'Electronique). Rev. Gen. Electr.; 83: No. 12, 914-916(Dec 1974). (In French).

From half-day meeting on the technical and economical management of a park of electric measuring apparatus; Malakoff, France (5 Oct 1972).

The constituents of the stock of measuring instruments at the Saclay Center are described, then all the items which are covered or not covered by a preventive maintenance schedule are listed. The consequences of the methods applied are discussed in terms of number of interventions and dead-times and the corresponding costs are examined. It is concluded that there is a relation between standardization and the operational life of the instruments. (FR)

11638 AN AUTORANGING DIGITAL RATEMETER. White, G. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Nucl. Instrum. Methods; 125: No. 2, 313-317 (1 Apr 1975).

A direct-reading digital ratemeter based on a relatively simple and flexible design is described. It is automatic in its range changing and, when measuring a random pulse sequence, the standard deviation can be selected by a switch in the range 0.2% to 7%. Depending upon the range and standard deviation selected, the associated time constants range from 2ms to 10,000s. The three modes of readout provided are three-decade numeric indicators, digital data, and analogue. (auth)

11639 THREE-DIMENSIONAL OBJECT RECONSTRUCTION FROM ORTHOGONAL PROJECTIONS. Chang, S. K. (Univ. of Illinois, Chicago). Trans. Am. Nucl. Soc.; 21: 104-105(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11640 RECONSTRUCTION OF THREE-DIMENSIONAL STRUCTURES WITH TRANSMISSIONS OF RADIATIONS. Cho, Z. H. (Univ. of California, Los Angeles). Trans. Am. Nucl. Soc.; 21: 105-106(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11641 EXTENSOMETER FOR THE MEASUREMENT OF BIAXIAL STRAIN OF MATERIAL SPECIMENS. Billeter, T. R.; Paxton, M. M. (Westinghouse Hanford Co., Richland, WA). Trans. Am. Nucl. Soc.; 21: 194-195(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11642 INTRINSIC THERMOCOUPLES PROMPT RESPONSES AND FAST TRANSIENTS: MEASUREMENT METHOD. Gat, U. (Oak Ridge National Lab., TN). Trans. Am. Nucl. Soc.; 21: 374-375(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11643 IN-SITU MEASUREMENTS OF THE RESPONSE TIME OF SHEATHED THERMOCOUPLES. Carroll, R. M. (Oak Ridge National Lab., TN); Shepard, R. L.; Kerlin, T. W. Trans. Am. Nucl. Soc.; 21: 427-428(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11644 GAMMA TRANSMISSION METHOD FOR THE DETERMINATION OF MOISTURE CONTENT IN SOILS. Saksena, R. S. (Univ. of Roorkee, India); Chandra, S.; Singh, B. P. J. Hydrol.; 23: No. 3/4, 341-352(Dec 1974).

Soil samples from strata down to 164 m were studied with respect to the linear attenuation coefficient and the mass absorption coefficient for gamma rays and their variation with moisture content. Details are given for three samples examined. The variation of gamma counting rate with moisture for different thicknesses of strata is also given. The reaction of clay samples was determined by the gamma transmission method and the explanation of such reaction is given. It is suggested that the stratification can also be determined by this method with the aid of the gamma-ray linear attenuation coefficient, which will also provide a method for the determination of the density of the soils in the various strata. The method is suggested also for the study of seasonal variation of moisture content. (NL)

11645 COMPARISON OF SEDIMENTATION-COMPRESSION CURVES OBTAINED BY NUCLEAR AND GRAVIMETRIC METHODS FOR WILKINSON BASIN, GULF OF MAINE, SEDIMENTS. Sung Kwun Chough; Richards, A. F. (Lehigh Univ., Bethlehem, PA). Mar. Geol.; 17: No. 4, 249-261(Dec 1974).

Accurate measurements of bulk density are important in the construction of sedimentation-compression curves of water-saturated, fine-grained cohesive sediments for consolidation studies. The bulk density of five cores was measured nondestructively on a laboratory nuclear transmission densitometer and the water content, expressed as void ratio, was derived from an empirical relationship between bulk density and water content. Bulk density and water content measured destructively was determined every 10 cm for a comparison with the nuclear data. Agreement between nuclear and gravimetric methods was within ± 0.02 g/cm^3 for bulk density ranging from 1.2 to 1.4 g/cm^3. Sedimentation-compression curves made using both methods were in generally good agreement. In the Wilkinson Basin, the void ratio gradually decreases with increasing effective overburden pressure. This indicates that consolidation by dewatering the surficial sediments is normal and that the environmental conditions during deposition remained relatively constant. (NL)

11646 DETECTION OF CORROSION BY A RADIOMETRIC TECHNIQUE. Charlton, J. S.; Ross, J. F. (to Imperial Chemical Industries Ltd,). US Patent 3,872,310, 18 Mar 1975. Priority date 17 Feb 1972, United Kingdom of Great Britain and Northern Ireland. 4p.

An apparatus for detecting corrosion in boiler tubes is described. The tube wall thickness of each tube is measured in situ in the bundle using a radioisotopic method. The degree of corrosion thus indicated is plotted on a diagram in a way which highlights the corroded tubes. (Official Gazette)

11647 ROENTGEN-BILDVERSTAERKER. Eingangsdurchmesser von Elektronenoptischen Roentgen-Bildverstaerkern und Roentgen-Bildverstaerkerroehren. Entwurf. (X-Ray Image Intensifiers. Entrance Diameter of Electronoptical X-Ray Image Intensifiers and X-Ray Image Intensifier Tubes. Draft). Berlin; Beuth (1973). 1p.

A standard draft for entrance diameter of electronoptical X-ray image intensifiers is presented. (GE)

11648 ROENTGEN-BILDVERSTAERKER. Bestimmung der Leuchtdichteverteilung von Elektronenoptischen Roentgen-Bildverstaerkern und Roentgen-Bildverstaerkerroehren. Entwurf. (X-Ray Image Intensifier. Evaluation of the Brightness Distribution of Electron-Optical X-Ray Image Intensifiers and X-Ray Image Intensifier Tubes. Draft). Berlin; Beuth (Sep 1973). 2p.

An evaluation of the brightness distribution of image intensifier tubes is presented. (GE)

ISOTOPE AND RADIATION SOURCE TECHNOLOGY

Isotope Separation (Industrial)

Refer also to abstract 12283.

11649 (NP-20433) EARLY HISTORY OF THE GAS CENTRIFUGE WORK IN THE U.S.A. Beams, J. W. (Virginia Univ., Charlottesville (USA)). May 1975. 53p. Univ. of Virginia, Charlottesville, VA.

Early work carried out in the US on isotope separation using gas centrifuges is reviewed. Emphasis is placed on the separation of uranium isotopes. A good deal of the work was carried out at the University of Virginia. (TFD)

11650 (UCID-16677) ISOTOPE SEPARATION OF LASER EXCITED MOLECULES BY USE OF SURFACE INTERACTION. Huss, E. B.; Fulk, M. M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 30 Oct 1972. Contract W-7405-Eng-48. 9p. Dep. NTIS $4.00.

The fundamental problem with many laser excitation isotope separations now being proposed is that in order to avoid collisional energy transfer before separation they must be operated at low pressure (equal to or less than 10^{-3} torr). This seriously limits the mass transfer rate and the excitation source energy which can be absorbed for a given path length. A physical process which might be used to effect an efficient separation of vibrationally excited molecules from their less excited companions with the potential of a sizeable mass transfer rate is the surface adsorption-desorbtion time. A rotating surface adsorption separator and laser illuminated column gas chromatographic devices which might be used to separate laser excited molecules are described. (TFD)

11651 (UCRL-76720) LASER ISOTOPE SEPARATION PROGRAM AT LAWRENCE LIVERMORE LABORATORY. Stern, R. C.; Snavely, B. B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 9 Apr 1975. 21p. (CONF-750460-5). Dep. NTIS $4.25.

From 3rd conference on the laser; New York, New York, USA (22 Apr 1975).

The feasibility and operating parameters of laser isotope separation (LIS) for producing enriched uranium are discussed. The Livermore LIS program is briefly described. (TFD)

11652 REALIZATION OF CLOSED CONTROL SYSTEMS FOR STABLE ISOTOPE SEPARATION PLANTS. Gogitidze, O. A.; Muskhelishvili, G. N.; Puradashvili, D. K.; Uturgaidze, Ts. D. Soobshch. Akad. Nauk Gruz. SSR; 78: No. 1, 173-176 (Apr 1975). (In Russian).

A method of realization of closed control systems for stable isotope separation plants is presented. It is based on the analysis of the information about the isotopic concentration along the columns and allows a solution of the cardinal problems concerning the development of ASCTP of stable isotope enrichment in packing columns. (auth)

11653 CO_2 TEA LASER-INDUCED PHOTOCHEMICAL ENRICHMENT OF BORON ISOTOPES. Freund, S. M.; Ritter, J. J. (National Bureau of Standards, Washington, D. C. (USA)). Chem. Phys. Lett.; 32: No. 2, 255-260(15 Apr 1975).

Mixtures of BCl_3 and H_2S are irradiated with 10.55 μm radiation (P(16) line of the 001-100 band of CO_2) from a TEA laser. After several hours of irradiation it is found that the maximum ^{10}B to ^{11}B ratio of recovered gaseous boron containing material (primarily unreacted BCl_3) is 0.413 ± 0.004. The corresponding ratio of the BCl_3 starting material is 0.242 ± 0.002. The ^{10}B concentration has therefore been increased from 19.5% to 29.2%. Further, by irradiating similar mixtures with 10.18 μm radiation (R(30) line of the same CO_2 vibrational band) this ratio changes to 0.169 ± 0.002, the ^{10}B concentration being lowered to 14.4%. All experiments are performed in a small static system and chemical procedures for recovering milligram quantities of BCl_3 selectively enriched in either isotope are described. (auth)

11654 EFFECT OF SEPARATION FACTORS ON PRODUCT ASSAY OF AN IDEAL CASCADE COMPOSED OF UF_6 CENTRIFUGES. Yamashita, S. (Sumitomo Atomic Energy Industries, Ltd., Tokyo); Okamoto, T. Nucl. Technol.; 26: No. 2, 215-223 (Jun 1975).

Kinetics equations using two assumptions describe an ideal cascade with accuracy. Using the kinetics equations, it is found that if the decrease of the separation factor in a selected stage is small, the product can be withdrawn at the product assay allowed for shipment without stopping the operation of the ideal cascade composed of the model centrifuges (approximately 4 kg SWU/yr, alpha equals 1.135). Moreover, the fraction of centrifuges permissible to stop in case of an accident is found to be 4 to 5 percent of the model centrifuges in each stage in the enriching section of the ideal cascade. (auth)

11655 POWERFUL FREQUENCY-TUNED NARROW-BAND LASER OF THE ULTRAVIOLET, VISIBLE, AND INFRARED RANGES ON A BASE OF NEODYMIUM GLASS FOR SELECTIVE PHOTOCHEMISTRY. Ambartsumyan, R. V.; Apatin, V. M.; Letokhov, V. S.; Mishin, V. I. (Inst. of Spectroscopy, Moscow). Kvantovaya Elektron. (Moscow); 2: No. 2, 337-342(Feb 1975). (In Russian).

A laser design was developed using neodymium glass with smooth tuning in the 200 Å band and with relative stability in the frequency of generation of 2×10^{-6}. With selective photodissociation of the mixture of H_2CO and D_2CO, an enrichment of hydrogen by deuterium in a ratio of 1:9 was obtained by radiation of the third harmonic. The laser emits pulses at a peak power from 10^6 to 10^8 W and may be successfully used in the field of laser spectroscopy, high-resolution spectroscopy, atmospheric probing, and selective photochemistry. The results of the investigation are graphically depicted with a detailed description of the design. (JPRS)

11656 URANIUM ENRICHMENT. Garg, R. K. (Bhabha Atomic Research Centre, Bombay). Vaigyanik.; 6: No. 2, 13-18; 32(Apr 1974). (In Hindi).

Various processes used for uranium enrichment are enumerated such as (1) electromagnetic separation (2) thermal diffusion (3) gaseous diffusion (4) gas centrifuge (5) nozzle separation and (6) the photochemical method. Technical problems encountered when these processes are employed on a production-scale are discussed. (INIS)

11657 OPERATING REGIME OPTIMIZATION OF MASS-DIFFUSION CASCADES. Chuzhinov, V. A.; Laguntsov, N. I.; Nikolaev, B. I.; Sulaberidze, G. A. At. Energ. (USSR); 38: No. 6, 363-366(Jun 1975). (In Russian).

Problems of optimization of mass diffusion elements (columns or pumps) in cascades are considered. Cost of production of the product being produced is proposed as the criterion of optimization. An expression for the cost of an isotope obtained in a mass diffusion cascade is presented. Possible applications of the cost function are considered. An example of operating regime optimization of a cascade and calculation of the cost of ^{13}C isotope in the form of methane is presented. (auth)

11658 PROPOSED INCREASE IN THE AMOUNT OF ENRICHED URANIUM WHICH MAY BE DISTRIBUTED TO THE EUROPEAN ATOMIC ENERGY COMMUNITY (EURATOM), SENATE, NINETY-FOURTH CONGRESS, FIRST SESSION, FEBRUARY 13, 1975. Washington, DC; Joint Committee on Atomic Energy (1975). 8p. GPO.

11659 PROPOSED MODIFICATION OF RESTRICTIONS ON ENRICHMENT OF FOREIGN URANIUM FOR DOMESTIC USE. Hearings Before the Joint Committee on Atomic Energy, Congress of the United States, Ninety-Third Congress, Second Session on Proposal for Gradual Relaxation and Ultimate Removal of Present Restrictions on Enrichment of Foreign Uranium Intended for Use in Domestic Power Reactors, September 17 and 18, 1974. Washington, DC; Joint Committee on Atomic Energy (1975). 240p. GPO.

11660 PROPOSED CHANGES IN AEC CONTRACT ARRANGEMENTS FOR URANIUM ENRICHING SERVICES. Hearings Before the Subcommittee on Energy of the Joint Committee on Atomic Energy, Congress of the United States, Ninety-Third Congress, First Session, to Consider the Impact of the Proposed AEC Changes in Terms and Conditions for Providing Uranium Enriching Services to Domestic and Foreign Customers, March 7, 8, 26; and April 18, 1973. Washington, DC; Joint Committee on Atomic Energy (1975). 820p. GPO.

11661 ISOTOPE SEPARATION BY GAS CENTRIFUGES WITH A CIRCULATING FLOW. Arai, M. (Tokyo Shibaura Electric Co. Ltd., Kawasaki, Kanagawa (Japan). Research and Development Center). Atomkernenergie; 25: No. 1, 47-52(1975).

Centrifuges in which a circulating flow exists are analyzed by the use of a model which gives a relation between the above centrifuges and those without the circulating flow. Results of numerical calculations of the differential equation of separation are also given. Both results are qualitatively the same. It is shown that, as the quantity of the circulating flow becomes larger,

the maximum separative power with respect to the quantity of feed gas is attained with the less quantity of the feed gas. The value of the maximum also decreases. The dependences of the separative power on the position of feed gas on the axis of a rotor are examined. Corrections to the above model are discussed by the use of an approximate solution of the differential equation of separation. (auth)

Isotopic Power Sources

Refer also to abstracts 11409, 11410, and 11412–11426.

11662 (MLM-1610) MOUND LABORATORY ISOTOPIC POWER FUELS PROGRAMS, JULY–SEPTEMBER 1969. (Mound Lab., Miamisburg, Ohio (USA)). 31 Oct 1969. Contract AT-33-1-GEN-53. 27p. Dep. NTIS $4.50.

Declassified 30 Aug 1973.

Research progress on the development of ^{238}Pu as an isotopic heat source is reported. (TFD)

11663 RADIOISOTOPE ^{238}Pu: FORECASTED NEEDS, AVAILABILITY, AND COST. Rock, B. J.; Thielke, N. R.; Tarr, T. D. (Energy Research and Development Administration, Washington, DC). Trans. Am. Nucl. Soc.; 21: 1-2(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11664 DESIGN, TESTING, AND FABRICATION OF HEAT SOURCES FOR UNDERWATER APPLICATIONS. Luthy, D. F.; Anderson, C. G. (Monsanto Research Corp., Miamisburg, OH). Trans. Am. Nucl. Soc.; 21: 7-8(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11665 ISOTOPE GENERATOR. (to Stichting Reactor Centrum Nederland). Netherlands Patent 7,307,512/A/. 29 May 1973. 7p. (In Dutch).

A radioisotope heat generator is described. The generator block contains the isotopes and heat transfer tubes and is enclosed in heat insulating material. The block is suspended in the thermal shielding by spokes fitted with a spring. The materials for block and spokes are chosen in such a way that their expansion coefficients (ec) compensate one another, i.e., the quotient ec of material for spokes over ec of material for block is smaller than 1. The shielding, containing the heat exchanger, is fitted to the block by groups of spokes perpendicular to the groups of spokes suspending the block in its own enclosure. (NL)

11666 HEAT GENERATOR WITH RADIOACTIVE ISOTOPES. (to Stichting Reactor Centrum Nederland). Netherlands Patent 7,307,511/A/. 29 May 1973. 7p. (In Dutch).

A heat generator for powering a thermodynamic engine is described. The holes, bored in the block that contains the capsules with radioactive isotopes, serve as ducts for the heat transferring medium. The ducts are clad with a porous material (capillary network) and are positioned horizontally. The fluid medium consists of partially evaporated liquid sodium and enters the ducts in equal amounts because of this positioning. Supersaturation of the capillary network is avoided. The heat exchanger is in direct contact with the same heated vapor, thus, loss of heat is avoided and the efficiency of the generator is improved. (NL)

Radiation Sources

11667 (REG/G-6,4(Rev.1)(5-75)) CLASSIFICATION OF CONTAINMENT PROPERTIES OF RADIOACTIVE SOURCES CONTAINED IN CERTAIN DEVICES TO BE DISTRIBUTED FOR USE UNDER GENERAL LICENSE. (Nuclear Regulatory Commission, Washington, D.C. (USA). Office of Standards Development). May 1975. 1p. NRC.

Section 32.51, "Byproduct Material Contained in Devices for Use under section 31.5; Requirements for License to Manufacture, Import or Distribute," of 10 CFR Part 32, "Specific Licenses to Manufacture, Distribute, or Import Certain Items Containing Byproduct Material;" requires, in part, that each application for a specific license to distribute devices containing byproduct material to persons generally licensed under section 31.5 of 10 CFR Part 31 include sufficient information relating to qualification testing of a prototype unit to provide reasonable assurance that the byproduct material in the device will be adequately contained. Frequently, retention of the byproduct material within the device is dependent on the containment properties of the source. This regulatory guide identifies terminology acceptable to the NRC staff for describing the containment properties of a source on a prototype testing basis. (auth)

11668 A RADIOACTIVE SOURCE CONTAINER OBTURATING DEVICE ACTUATED BY THE SOURCE TO-AND-FROM MOVEMENTS. Chiabodo, B. French Patent 2,210,805/A/. 14 Dec 1972. 6p. (In French).

Description is given of a radioactive or ionizing source container obturating device, characterized in that the opening and closing of the obturator are controlled by the movements of the source when penetrating into, or leaving, the container, means being provided for showing whether the source-holder is complete. The apparatus comprises a retractable flexible obturator actuated by the movements of the source, without any manual intervention. The obturator opening and closing result from the thrust exerted by the source holder against the front- or rear-wall of its housing without requiring the handling of a cocking means. (FR)

11669 LOADING AND TESTING A CALIFORNIUM FLUX MULTIPLIER. Rundquist, d. E.; Crosbie, K. L.; Preskitt, C. A (IRT Corp., San Diego, CA). Trans. Am. Nucl. Soc.; 21: 150-151 (Jun 1973).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

Design and Fabrication

11670 DEVELOPMENT OF CALIFORNIUM-252 SEALED SOURCES AT THE COMMISSARIAT A L'ENERGIE ATOMIQUE. Barthelemy, P.; Berger, R.; Boucher, R.; Hayet, L. (CFA, Fontenay-Aux-Roses, France). Nucl. Technol.; 26: No. 2, 201-214(Jun 1975).

In 1971 the French Atomic Energy Commission (CEA) established itself as a candidate for ^{252}Cf commercial encapsulation services. A production facility, designed and built at the Fontenay-aux-Roses Centre for Nuclear Studies, allows handling of up to 10 mg of ^{252}Cf. This unit started operation in Sep, 1973. The main features of the californium facility are: (a) remote manipulation by means of two electrical robots, (b) TIG welding of capsules and assemblies using two machines, with variable positioning of the electrode along the three axis that allows the soldering of pieces as large as 50 mm in diameter and 2 m in length, (c) capsule decontamination by an electrolytic pickling technique, and (d) neutron source emission counting by means of a uranium fission chamber giving relative measurements versus a ^{252}Cf standard with an accuracy of 3 percent. All sealed sources developed at the CEA are made of $^{252}Cf_2O_3$-Pd cermets encapsulated in stainless steel, Zircaloy, or nickel and are qualified as special form nuclear material. Present applications of ^{252}Cf sealed sources in France are directed toward physical research and nuclear reactor design, nuclear reactor startup and nuclear materials assay, neutron activation analysis development for in situ determinations in the earth science and mineral exploration, and for process control in metallurgy. Furthermore, the CEA is involved in a government-sponsored program on a ^{252}Cf source projector for neutron therapy. For the afterloading interstitial technique, the CEA has designed miniaturized sources made of a $^{252}Cf_2O_3$-Pd cermet containing 0.32 mug of ^{252}Cf sealed in a plutonium capsule 0.70 mm in dia and 4 mm long. (auth)

Industrial Uses

Refer also to abstract 11703.

11671 (EURISOTOP-26) USE OF RADIOACTIVE TRACERS IN THE STUDY OF MATERIAL MOTION IN A ROTARY TUBE OVEN. Akerman, K. (Commission of the European Communities, Brussels (Belgium). Bureau Eurisotop). Nov 1973. 158p. (In German). (RN-143926). Dep. NTIS (US Sales Only) $11.00.

The design and operation of rotary tube ovens are summarized and the motions of solid phases and the development and movement of dust and gases in these ovens are described. The use of radioisotopic tracers in determining the processes occurring in these ovens is described on the basis of specific industrial examples. The examples considered are Fe ore processing by the Krupp-Renn method, rolling process in the Zn industry, production of Portland cement, production of H_2SO_4 and cement clinkers from potassium sulfate, production of a light filler for cement, calcining of sodium bicarbonate, calcining of dolomite, production of superthomasin, production of sodium metasilicate, and calcining of alumina. Possibilities for the further improvement of radioisotopic studies of the motion of material in rotary ovens are surveyed. (JSR)

11672 (STI/PUB-372) RADIATION ENGINEERING IN THE ACADEMIC CURRICULUM. Panel Proceedings Series. Proceedings of a Study Group Meeting, Haifa, 27 August–4 September 1973. (International Atomic Energy Agency, Vienna (Austria)). 1975. 362p. (CONF-730866-). IAEA $22.00.

A separate abstract was prepared for each of the twenty papers presented at the conference. (TFD)

For abstracts of individual papers see: 11495, 11496, 11624–11629, 11675–11682, 11895, 11896, 12275, and 12276.

11673 EXPERIMENTAL TESTS ON THE APPLICABILITY OF A RADIOACTIVE TRACER TECHNIQUE FOR MEASURING COOLANT MIXING IN NUCLEAR REACTOR FUEL SUBASSEMBLIES. Castellani, F. (Univ., Pisa, Italy); Curzio, G.; Pieve, L.; Grazzini, R. Nucl. Eng. Des.; 32: No. 1, 105-109(Apr 1975).

A previously reported radioactive tracer technique for measuring coolant mixing is developed. Feasibility of the technique is demonstrated with a test section simulating part of a reactor sub-channel. The test section consisted of a tube containing three hollow rods simulating the fuel rods, mounted in a small hydraulic loop. Tests were carried out by injecting a ^{32}P activated phosphate into the main flow at Reynolds number ranging from 20,000 to 70,000. The concentration of the tracer was measured by detecting the β-rays of ^{32}P with three windowless Geiger-Müller counters, placed inside the hollow rods, β-particles reach the counters through openings in various axial positions along the length of the rods, covered by a thin stainless steel foil. Measured values of the concentration are reported and corresponding values of coolant cross-flow are calculated. (auth)

11674 MEASUREMENT OF THE CIGARETTE AIR VOLUME WITH RADIOACTIVE ARGON. Williamson, T. G.; (Univ. of Virginia, Charlottesville); Batalo, D. P.; Jenkins, R. W.; Frisch, A. F. Trans. Am. Nucl. Soc.; 21: 134-135(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11675 INTERACTION BETWEEN NUCLEAR AND OTHER SCIENCES INCLUDING ENGINEERING. Houtman, J. P. W. (Interuniversity Reactor Inst., Delft, Netherlands). pp 5-24 of Radiation Engineering in the Academic Curriculum. Vienna; International Atomic Energy Agency (1975).

From proceedings of a study group on radiation engineering in the academic curriculum; Haifa, Israel (27 Aug 1973). See STI/PUB-372; CONF-730866-.

The experience of the Interuniversity Reactor Institute in the Netherlands is presented in relation to its ten-year history in the development of interaction between nuclear and other sciences. From this experience the author draws a series of conclusions with regard to the encouragement of widespread use of radiation and radioisotopes in non-nuclear fields of science and engineering. The importance of a special research center involving university people is stressed and specific examples of successful interdisciplinary programs are presented. A training approach aimed at enabling every scientist or engineer eventually to make an adequate choice between various nuclear and more conventional techniques for solving his problems is discussed. (auth)

11676 RADIATION ENGINEERING: FROM A COLLECTION OF FACTS TO AN ORGANIZED DISCIPLINE. Segal, Y.; Notea, A. (Israel Inst. of Tech., Haifa, Israel). pp 63-69 of Radiation Engineering in the Academic Curriculum. Vienna; International Atomic Energy Agency (1975).

From proceedings of a study group on radiation engineering in the academic curriculum; Haifa, Israel (27 Aug 1973). See STI/PUB-372; CONF-730866-.

The application of radiation and radioisotope techniques has shown its potential in a wide spectrum of scientific and technological fields. However, its progress is hampered by the lack of specialists with proper training. This situation can be remedied by introducing "radiation engineering" in the framework of the regular academic curriculum, thus ensuring the availability of specialists in the field. As time is always a restricting factor in establishing a curriculum, the efficacy of the teaching method is extremely important. Consequently the curriculum should form a framework within which facts and experiences are organized and intelligible. A curriculum that lacks this kind of conceptual structure becomes merely an encyclopaedia of facts. One approach to the organization and presentation of material based on macroscopic characterization of source-medium-detector systems, is suggested. An operational concept in dealing with units such as detectors, collimators, filters, etc., is introduced. As there is a demand for graduates with varying degrees of specialization, three separate training programs are presented. (auth)

11677 RADIATION ENGINEERING LABORATORY FOR ENGINEERING STUDENTS. Notea, A.; Segal, Y. (Israel Inst. of Tech., Haifa, Israel). pp 71-85 of Radiation Engineering in the Academic Curriculum. Vienna; International Atomic Energy Agency (1975).

From proceedings of a study group on radiation engineering in the academic curriculum; Haifa, Israel (27 Aug 1973). See STI/PUB-372; CONF-730866-.

The proposed radiation engineering laboratory is an integral part of the curriculum in radiation engineering. In this laboratory the student applies the theoretical knowledge he has gained in courses on the applications of radiations and radioisotopes. It is assumed that the student has already studied basic courses including a preliminary laboratory course. Hence he is acquainted with the elementary units used in source-medium-collimator-detector systems. It is recommended that the preliminary experiments will be conducted in the radiation engineering laboratory using the same equipment; this will enhance the interest of the student in the basic experiments. An effort was made to construct projects that are simulations of real industrial situations. To stimulate term work and to save floor space and equipment the students work in groups of two and three. Each member of the team deals with a different aspect of the project and thus might reveal his ability for innovation. The laboratory includes subjects such as: mass transfer studies by tracers, transmission gauges, backscattering gauges, activation analysis, etc. Every subject is divided into several projects whose nature and depth are tailored to the available budget, background and aspirations of the student, and his anticipated future activity. A suggested list of projects has been compiled. All projects are based on relatively inexpensive equipment and do not require an accelerator or reactor. (auth)

11678 RADIATION ENGINEERING AND PROCESSING IN THE ACADEMIC CURRICULUM; Lapidot, M. (Soreq Nuclear Research Center, Yavne, Israel). pp 101-113 of Radiation Engineering in the Academic Curriculum. Vienna; International Atomic Energy Agency (1975).

From proceedings of a study group on radiation engineering in the academic curriculum; Haifa, Israel (27 Aug 1973). See STI/PUB-372; CONF-730866-.

The paper discusses the basic, technical and technological aspects of the design, manufacture and use of large radiation sources. It is divided into three sections that deal with source technology and related aspects of radiation engineering, with radiation sterilization processes, and with radiation processes in the food and agricultural fields. The training requirements for educating specialists in these areas are emphasized. An appendix includes specific topics for courses in these fields. (auth)

11679 RADIATION ENGINEERING: A ONE-YEAR COURSE FOR STUDENTS IN CHEMICAL AND NUCLEAR ENGINEERING. Silverman, J. (Univ. of Maryland, College Park). pp 115-120 of Radiation Engineering in the Academic Curriculum. Vienna; International Atomic Energy Agency (1975).

From proceedings of a study group on radiation engineering in the academic curriculum; Haifa, Israel (27 Aug 1973). See STI/PUB-372; CONF-730866-.

The paper describes the author's experience in teaching a course called "Radiation Engineering" offered to graduate students in the nuclear engineering and chemical engineering program at the University of Maryland. (auth)

11680 TRACER TECHNIQUES IN ENVIRONMENTAL SYSTEM STUDIES: THEORETICAL INTRODUCTION. Nir, A. (Weizmann Inst. of Science, Rehovot, Israel). pp 291-305 of Radiation Engineering in the Academic Curriculum. Vienna; International Atomic Energy Agency (1975).

From proceedings of a study group on radiation engineering in the academic curriculum; Haifa, Israel (27 Aug 1973). See STI/PUB-372; CONF-730866-.

The present emphasis on systems approach in environmental problems leads to a renewed interest in the use of tracers and especially environmental isotopes in systems analysis. Students of nuclear science and engineering are not adequately prepared for these types of application and no systematic presentation of theoretical basis is known to exist. The paper offers an attempt at systematic presentation, based in part on concepts of chemical and electronic engineering. These, however, have to be modified in order to realize the full potential of tracer methodology. Steady-state systems are treated as a special case of time-varying systems requiring more advanced deterministic or stochastic analysis. The methods presented should be of use to other disciplines outside the realm of geosciences. Examples of instructional material are included. (auth)

11681 INDUSTRIAL SYSTEMS ANALYSIS BY RADIOACTIVE TRACERS. Ljunggren, K. (Isotope Techniques Lab., Stockholm). pp 307-316 of Radiation Engineering in the Academic Curriculum. Vienna; International Atomic Energy Agency (1975).

From proceedings of a study group on radiation engineering in the academic curriculum; Haifa, Israel (27 Aug 1973). See STI/PUB-372; CONF-730866-.

A tracer must behave in the same manner as the matter to be traced, except that it should be selectively and specifically

measurable during and/or after the process studied occurs. The paper discusses the recent developments in systems studies applied to industrial processes. Tracers, and especially radioactive tracers, have gradually become integrated into process analysis as a measuring tool for obtaining data on industrial systems. The principles and applications of the tracer method and their incorporation into an academic curriculum are discussed with regard to the process industries. (auth)

11682 TRAINING THE ENGINEER FOR RADIOTRACER APPLICATIONS IN INDUSTRY. Fries, B. A. (Chevron Research Co., Richmond, CA). pp 317-345 of Radiation Engineering in the Academic Curriculum. Vienna; International Atomic Energy Agency (1975).

From proceedings of a study group on radiation engineering in the academic curriculum; Haifa, Israel (27 Aug 1973). See STI/PUB-372; CONF-730866-.

Opportunities to apply radioactivity in industry arise largely in the process industries. These are dynamic industries where operating problems develop suddenly and require quick solutions. Despite their proven usefulness, the application of radioisotopes remains a greatly underutilized technique in industry. Possibly a lack of demand for the radioisotope engineer and a lack of such trained engineers, who could stimulate demand, retard the utilization of radiation methods. The paper discusses some principles of industrial radiotracer applications and discusses appropriate curricula topics for training radiation engineers. (auth)

LIFE SCIENCES

Radiation Effects on Biochemicals

Refer also to abstracts 11694, 11695, 11697, 11711, and 11817.

11683 (JPRS-62942) EFFECTS OF NONIONIZING ELECTROMAGNETIC RADIATIONS. Fedorova, I. S.; Aripov, T. F.; Tikhonchuk, V. S.; Molchanova, N. S. 12 Sep 1974. Translated from pp 198-206 of Voenno-Polevaya Terapiya, Leningrad, 1973. 33p. NTIS $3.75.

The report contains articles on the calculation of the distribution function for the diameters of thin-walled spheres on the basis of: electromagnetic radiation scatter data; microwave saturation effects on paramagnetic centers of proteins irradiated with ultraviolet light; the effects of superhigh frequency electromagnetic fields (SHF-EMF) on the body; and the effects of combined SHF and gamma irradiation on hemopoiesis. (GRA)

11684 INFLUENCE OF IRRADIATION CONDITIONS ON RADIOINDUCED ACIDITY IN SOLID STATE GLUCOSE. Rigouard, A.; Berger, G.; Saint-Lebe, L. (CEA Centre d'Etudes Nucleaires de Cadarache, 13-Saint-Paul-les-Durance (France). Service de Radio-Agronomie). C. R., Ser. D.; 280: No. 6, 763-766(10 Feb 1975). (In French).

Radioinduced acidity in solid state glucose is studied as a function of irradiation conditions (dose, dose rate, temperature, atmosphere composition), glucose characteristics (physical structure, water content), and post-irradiation treatments (presence of gas in dissolving water, storage). (FR)

11685 RESTORATION OF THE CAPACITY FOR GROWTH IN IRRADIATED PLANT TISSUE BY SOLUBLE RNA AND NUCLEOTIDES FROM YEAST. The Restoration Factor in Yeast Soluble RNA is in the Mononucleotide Fraction. Ravelomanana, D.; Ohlenbusch, H. H.; Jonard, R. (Montpellier-2 Univ., 34 (France)). C. R., Ser. D.; 280: No. 8, 1047-1050(24 Feb 1975). (In French).

The restoration factor in soluble RNA of yeast is in the mononucleotide fraction. Since the major RNA bases show no restorative activity, the active factor could be the soluble nucleotides with cytokinin activity. (FR)

11686 ULTRAVIOLET PHOTOSENSITIVITY OF THE ESTROGEN BINDING PROTEIN FROM RAT UTERUS. WAVELENGTH AND LIGAND DEPENDENCE. Photocovalent Attachment of Estrogens to Protein. Katzenellenbogen, J. A. (Univ. of Illinois, Urbana); Ruh, T. S.; Carlson, K. E.; Iwamoto, H. S.; Gorski, J. Biochemistry; 14: No. 11, 2310-2316(3 Jun 1975).

Ultraviolet irradiation of the estrogen binding protein in rat uterine cytosol results in a progressive photoinactivation which is rapid at 254 nm and slower at greater than 315 nm. Both unfilled and estradiol-filled sites are inactivated at approximately the same rates at 254 nm ($t/sub 1/2$ equals 8 min and 11 min, respectively), but at 315 nm, empty sites are consumed much more rapidly ($t/sub 1/2$ equals 3.4 hr) than filled ones ($t/sub 1/2$ equals 24 hr). The protective effect of the estrogen ligand at this wavelength appears to depend on its binding to the estrogen-specific binding site, as inactivation rate studies at different concentrations of estrone, estradiol, and estriol show a good correlation between the extent of protection and the fractional saturation of the high affinity estrogen binding sites. Scatchard analysis indicates that inactivation is the result of a loss of binding sites and not a decrease in their affinity, and sedimentation analysis shows that increased heterogeneity and aggregation of the estrogen binding species accompanies the photoinactivation process. Photoinactivation appears to be the result of direct irradiative damage of the amino acid residues, as the inactivation rate is the same under air and nitrogen atmospheres, and is unaffected by nucleophiles, reductants, and radical scavengers. When photoinactivation is measured by irradiation of cytosol containing [^{3}H]estradiol, a concurrent photocovalent attachment process is noted; the steroid becomes linked to protein in a solvent-inextractable manner (boiling ethanol inextractable). This attachment, however, does not appear to be related to the steroid binding at the estrogen binding site. Its rate is affected by reductants and scavengers. A similar photocovalent attachment reaction occurs when bovine serum albumin or ovalbumin is irradiated in the presence of [^{3}H]estradiol or [^{3}H]diethylstilbestrol. The detailed reactions involved in this photocovalent attachment process have not been defined at present. (auth)

11687 THE X-IRRADIATION INDUCED CONVERSION OF 3-IODO-L-TYROSINE INTO L-TYROSINE AND L-DOPA IN AQUEOUS SOLUTION AT 25°C. Ehrl, A. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (F. R. Germany). Inst. fuer Biologie). Atomkernenergie; 25: No. 1, 65-69(1975). (In German).

When 3-iodo-L-tyrosine was irradiated in aqueous solution at room temperature, L-tyrosine and L-dopa were formed exclusively. Results obtained from thin-layer separation were checked by Rf values of unirradiated substances. Spots of irradiation products could be identified by measuring the uv-reflectance and comparing with spectra of checking substances on the same silica gel plate. Irradiation induced conversion of 3-iodo-L-tyrosine into L-tyrosine was found being reverse to the biosynthesis of thyroid gland substances. L-dopa however was formed irreversibly. In metabolism, L-dopa can be transformed into distinct hormones, neurotransmitters, and pigments. (auth)

Radiation Effects on Cells

Refer also to abstract 11722.

11688 (CONF-740369-, pp 365-384) IMMUNOTHERAPY OF CANCER: INHIBITION OF GROWTH OF AN ESTABLISHED TUMOR USING NEURAMINIDASE TREATED TUMOR VACCINE. Ray, P. K.; Thakur, V. S.; Sundaram, K. (Bhabha Atomic Energy Research Centre, Trombay, India). 1974.

From symposium on biological approach to problems in medicine, industry and agriculture; Bombay, India (12 Mar 1974).

In proceedings of the symposium on biological approach to problems in medicine, industry, and agriculture.

Fibrosarcoma cells were incubated with Vibrio cholerae neuraminidase (VCN) at 37°C for one hr for preparation of the tumor vaccine. Mice were inoculated subcutaneously with untreated tumor cells, VCN-treated tumor cells, and x-irradiated tumor cells. Results indicated that animals inoculated with irradiated tumor cells did not develop immunity as effectively as those inoculated with VCN-treated cells. (HLW)

11689 CHANGES IN THE ORGANIZATION OF CHROMOSOMES DURING THE CELL CYCLE: RESPONSE TO ULTRAVIOLET LIGHT. Schor, S. L.; Johnson, R. T.; Waldren, C. A. (Cambridge Univ., Eng.). J. Cell Sci.; 17: No. 3, 539-565(May 1975).

Fusion between mitotic and interphase cells resulted in the premature condensation of the interphase chromosomes into a morphology related to the position in the cell cycle at the time of fusion. These prematurely condensed chromosomes (PCC) have been used in conjunction with uv irradiation to examine the interphase chromosome condensation cycle of HeLa cells. The following observations have been made: (1) There was a progressive decondensation of the chromosomes during G_1 which was accentuated by uv irradiation. (2) The chromosomes became more resistant to uv-induced decondensation during G_2 and mitosis. (3) There was a close correlation between the degree of chromosome decondensation and the amount of unscheduled DNA synthesis induced by uv irradiation during G_1 and mitosis. (4) Hydroxyurea enhanced the ability of uv irradiation to promote the decondensation of chromosomes during G_1, G_2, and mitosis. Hydroxyurea also potentiated the lethal action of uv irradiation during mitosis and G_1. These data are discussed in relation to the suggestion that chromosomes undergo a progressive decondensation during G_1 and condensation during G_2. (auth)

11690 BIOLOGICAL SURFACE DOSIMETRY OF THE COBALT-60 γ RAYS. Papadopoulo, D.; Coppey, J.; Bielle, L.; Genty, P. (Institut du Radium, 75-Paris (France)). C. R., Ser. D.; 280: No. 1, 145-148(6 Jan 1975). (In French).

Monolayers of monkey kidney epithelial cells (CV-1) were covered with different thickness of buffer from 0 to 5 mm. Under those conditions, cells were irradiated with γ rays of ^{60}Co and the residual cell division capacity was measured. The results showed that the dose absorbed at the surface was about 20% of the dose absorbed at 5 mm. Moreover the absorbed dose increased principally within the first 2 mm. (FR)

11691 RADIATION PROCESSES IN RED BLOOD CELLS: ESR EVIDENCE FOR ELECTRON LOSS BY IRON (II) HAEMOGLOBIN. Symons, M. C. R. (Univ. of Leicester, Eng.). J. Chem. Soc. (London), Chem. Commun.; No. 9, 357-358(7 May 1975).

Red blood cell suspensions, after exposure to ^{60}Co γ rays, gave ESR features characteristic of Fe^{III} in a spin-paired configuration. (auth)

11692 DNA REPAIR IN HUMAN/EMBRYONIC CHICK HETEROKARYONS. Ability of Each Species to Aid the Other in the Removal of Ultraviolet-Induced Damage. Paterson, M. C.; Lohman, P. H. M.; Westerveld, A.; Sluyter, M. L. (Leiden State Univ.). Biophys. J.; 14: No. 11, 835-845(Nov 1974).

Cultured human and embryonic chick fibroblasts possess different enzyme-mediated processes to repair cyclobutyl pyrimidine

dimers induced in their deoxyribonucleic acid (DNA) by ultraviolet (uv) radiation. While dimers are corrected in human cells by excision repair, a photoenzymatic repair process exists in embryonic chick cells for the removal of these potentially deleterious uv photoproducts. We have utilized a sensitive enzymatic assay to monitor the disappearance, i.e., repair, of dimer-containing sites in fused populations of human and chick cells primarily consisting of multinucleate human/chick heterokaryons. Fused cultures were constructed such that uv photoproducts were present only in chick DNA when evaluating excision repair and only in human DNA when evaluating photoenzymatic repair. Based on the kinetics of site removal observed in these cultures we are led to conclude the following: Within heterokaryons per se the photoreactivating enzyme derived from chick nuclei and at least one excision-repair enzyme (presumably a uv endonuclease) derived from human nuclei act on uv-damaged DNA in foreign nuclei with an efficiency equal to that displayed toward their own nuclear DNA. Hence, after cell fusion these chick and human repair enzymes are apparently able to diffuse into foreign nuclei and once therein competently attack uv-irradiated DNA independently of its origin. In harmony with the situation in nonfused parental cultures, in heterokaryons the chick photoenzymatic repair process rapidly removed all dimer-containing sites from human DNA including the residual fraction normally acted upon slowly by the human excision-repair process. (auth)

11693 DNA REPAIR IN POTOROUS TRIDACTYLUS. Buhl, S. N.; Setlow, R. B.; Regan, J. D. (Univ. of Tennessee, Oak Ridge, TN). Biophys. J.; 14: No. 10, 791-803(Oct 1974).

The DNA synthesized shortly after ultraviolet (uv) irradiation of Potorous tridactylis (PtK) cells sediments more slowly in alkali than that made by nonirradiated cells. The size of the single-strand segments is approximately equal to the average distance between 1 or 2 cyclobutyl pyrimidine dimers in the parental DNA. These data support the notion that dimers are the photoproducts which interrupt normal DNA replication. Upon incubation of irradiated cells the small segments are enlarged to form high molecular weight DNA as in nonirradiated cells. DNA synthesized at long times (approximately 24 h) after irradiation is made in segments approximately equal to those synthesized by nonirradiated cells, although only 10 to 15 percent of the dimers have been removed by excision repair. These data imply that dimers are not the lesions which initially interrupt normal DNA replication in irradiated cells. In an attempt to resolve these conflicting interpretations, PtK cells were exposed to photoreactivating light after irradiation and before pulse-labeling. After 1 h of exposure approximately 35 percent of the pyrimidine dimers have been monomerized, and the reduction in the percentage of dimers correlates with an increased size for the DNA synthesized by irradiated cells. However, at 24 h after irradiation and 1 h of photoreactivation there are no endonuclease-sensitive sites, even though approximately 50 percent of the pyrimidine dimers remain in the DNA. These data indicate that not all pyrimidine dimers are accessible to the repair endonuclease. (auth)

Radiation Effects on Microorganisms

11694 (COO-3271-5) FINAL REPORT OF TWENTY-TWO YEARS OF AEC SUPPORT, 1953–1975. Herriott, R. M. (Johns Hopkins Univ., Baltimore, Md. (USA)). 1975. Contract E(11-1)-3271. 29p. Dep. NTIS $4.50.

Results are reported for: the partial clarification of many aspects of genetic transformation in H. influenzae; control of the many facets of the metabolic and genetic pathways of this organism; development of a totally defined medium for both growth and for competence; the discovery, analysis of kinetics and purification of the photoreactivating enzyme; the formation of new genetic units (heterozygotes) during renaturation of mixtures of transforming DNA and finally; the generation of mutations in free wild type DNA by nitrous acid or by thymine hydroperoxide. The latter mutagen is formed in DNA exposed to ionizing radiation and explains the mutations induced in genetic material by ionizing radiation. In addition to these research results, graduate students, postdoctorates and faculty have been trained in the molecular mechanisms of genetic processes through the study of transformation. (auth)

11695 (ORO-3941-24) MECHANISMS OF RECOMBINATION AND FUNCTION OF DNA IN BACTERIA. Annual Progress Report, May 9, 1974–May 2, 1975. Guild, W. R. (Duke Univ., Durham, N. C. (USA). Dept. of Biochemistry). 1975. Contract AT(40-1)-3941. 12p. Dep. NTIS $4.00.

Work has continued on the description and analysis of genetic transformation in pneumococcus. In the current period major effort has gone into examining two aspects of the fate of the donor-recipient heteroduplex, one concerned with the interaction between the hex-dependent attack on base mismatches and the length of the donor strand, and the other with the effect of uv lesions in stimulating recombination over short distances in transformation, in spite of its overall deleterious effect on absolute transforming activity. The latter results suggested a new insight into stimulated recombination in general, namely that much of it may represent stimulated conversion in a pre-existing heteroduplex rather than simply the stimulation of physical crossovers themselves. (auth)

11696 (SAND-74-0076) SANDIA LABORATORIES TECHNICAL CAPABILITIES: BIOSCIENCES. Lundergan, C. D. (Sandia Labs., Albuquerque, N. Mex. (USA)). May 1975. Contract AT(29-1)-789. 16p. Dep. NTIS $4.00.

This report characterizes the biosciences capabilities at Sandia Laboratories. Selected applications of these capabilities are presented to illustrate the extent to which they can be applied in research and development programs. (auth)

11697 (SU-326P32X6) STUDIES ON THE REPAIR OF DAMAGED DNA IN BACTERIOPHAGE, BACTERIAL AND MAMMALIAN SYSTEMS. Progress Report. (Stanford Univ., Calif. (USA)). 27 Mar 1975. Contract AT(04-3)-326. 7p. Dep. NTIS $4.00.

Progress is reported on the following research projects: effects of T4 uv endonuclease on the DNA strand containing a pyrimidine dimer; kinetics of dimer excision in T4-infected cells in vivo; measurement of size of dimer-containing oligonucleotides excised from specifically incised DNA; N-glycosidase activity in cell-free preparation of Escherichia coli and Bacillus subtilis; chromatographic separation of thymine and thymine dimer; and dimer excision from unincised uv-irradiated DNA by extracts of human cells. (HLW)

11698 EFFECTS OF DISCRETE NUCLEAR UV-MICROBEAM IRRADIATION ON HERPES VIRUS AND SV40 INFECTION. Deak, I. I.; Defendi, V. (Oxford Univ.). J. Cell Sci.; 17: No. 3, 531-538(May 1975).

The requirement for a nucleolus in the expression of structural genes of nuclear viruses was examined by means of experiments in which the nucleolus or other parts of the nucleus were inactivated by a microbeam of ultraviolet light. These experiments showed that the expression of such genes was not dependent on nucleolar function. This conclusion is discussed in the light of previous experiments in which similar inactivation of the nucleolus was shown to prevent the expression of cellular structural genes. (auth)

11699 PHAGE P1 MUTANTS WITH ALTERED TRANSDUCING ABILITIES FOR ESCHERICHIA COLI. Wall, J. D.; Harriman, P. D. (Duke Univ., Durham, NC). Virology; 59: No. 2, 532-544 (Jun 1974).

A search was made for mutants of the coliphage P1 with altered transducing frequencies. A method was developed for the rapid assay of transducing frequencies in single plaques using prophage lambda as the transduced bacterial marker. This procedure selects for mutants altered in their ability to package host DNA. Mutants with 5 to 10 times higher or 10 to 20 times lower frequencies than those of wild-type P1 were found. Not only are the markers used for the detection of the mutants affected, but all other markers are similarly affected (not always to the same extent). One of the high-transducing frequency mutants is a suppressible amber, indicating that loss of a function increases P1's ability to package host DNA preferentially. (auth)

11700 IS BACTERIOPHAGE T4 DNA POLYMERASE INVOLVED IN THE REPAIR OF ULTRAVIOLET DAMAGE. Schnitzlein, C. F.; Albrecht, L.; Drake, J. W. (Univ. of Illinois, Urbana). Virology; 59: No. 2, 580-583(Jun 1974).

Defects in bacteriophage T4 gene 43 (DNA polymerase) do not enhance the ultraviolet sensitivity of the virus, even when the host DNA polymerase I is also defective. Methods are described for markedly enlarging T4 plaque sizes. (auth)

11701 RESTRICTION OF PHAGE T4 INTERNAL PROTEIN I MUTANTS BY A STRAIN OF ESCHERICHIA COLI. Black, L. W.; Abremski, K. (Univ. of Maryland, Baltimore). Virology; 60: No. 1, 180-191(Jul 1974).

Phage T4 internal protein I(IPI), a small (ca, 10,000 MW), basic protein injected into the host with the phage DNA, is not required for infection of most hosts, but mutants defective in IPI are restricted by at least one naturally occurring strain of Escherichia coli, CT 596 (CT). Phages lacking IPI (IPI$^-$) appear to inject their DNA and bind it to the membrane of CT cells as well as wild-type phage T4 does, but shutoff of host protein synthesis, initiation of T4 protein synthesis, and cell killing are abnormal in the IPI$^-$ mutant infected CT host. The injection of IPI appears to be important in allowing T4 DNA to carry out early steps involved in takeover of this host. Restriction of IPI$^-$ phage growth by CT cells appears to be due, at least in part, to a defective prophage it harbors which renders the host resistant to successful infection

by phage T4 which lack IPI or rII functions. Bacteria cured of this prophage can be infected by mutants defective in these functions. The resistance of CT cells to other coliphages, and the question of T-even phage internal protein diversity are discussed. (auth)

11702 THYMUS-DEPENDENT SENSITIZING PROCESSES INVOLVED IN THE INDUCTION OF CNS DISEASE IN MICE BY PARAINFLUENZA TYPE 1 VIRUS. Iwasaki, Y.; Aden, D.; Koprowski, H. (Univ. of Pennsylvania, Philadelphia). J. Immunol.; 114: No. 6, 1846-1847(Jun 1975).

Parainfluenza type 1 virus injected intracerebrally into adult mice induced a mononuclear cell infiltration in the subarchnoidal and perivascular spaces, exudation of inflammatory cells into parenchymal tissue and preferential chronic degeneration of white matter. No correlation was found between the severity of the central nervous system (CNS) lesions and the levels of circulating hemagglutination inhibition antibody. Inactivation of the virus by ultraviolet light (uv) did not affect the ability of the virus to produce the CNS lesions in these mice. As part of an inquiry into the mechanisms involved in the production of CNS lesions, the present study reports the response of athymic nude mice and sensitization through prior CNS exposure to virus antigen in immunocompetent mice. (auth)

11703 RADIOSTERILIZATION OF BREADS AND FRUIT-CAKES. Jemmali, M. (Institut National de Recherches Agronomiques (INRA), 75-Paris (France). Station de Biochimie et Physico-Chimie des Cereales); Manchon, P.; Buquet, A. (Conservatoire National des Arts et Metiers (CNAM), 75-Paris (France). Institut Scientifique et Technique de l'Alimentation). Ind. Aliment. Agric. (Paris).; 91: No. 9, 1129-1131(1974). (In French).

Cobalt γ sterilization was proved on breads and fruit-cakes. Various doses of irradiation in a 50 to 3000 krads range show that a 250 krads dose is the practical efficiency threshold for baking and pastry products. (FR)

11704 SENSITIZATION OF RADIATION RESISTANT YEASTS BY SULFUROUS ACID. Dorange, J. L.; Dupuy, P. (Institut National de Recherches Agronomiques (INRA), 21-Dijon (France). Station de Technologie des Produits Vegetaux). C. R. Soc. Biol.; 168: No. 4, 496-501(1974). (In French).

An ionizing radiation resistant diploid strain of S. cerevisiae is sensitized by SO_2 at acid pH, contrary to other less resistant strains. Sensitization also occurs by addition of SO_2 after irradiation. It disappears after incubation at 28°C. From this dominant genetic character it is thought that SO_2 interferes in the repair process. (FR)

11705 INFLUENCE OF SEX FACTOR ON SPONTANEOUS AND INDUCED FREQUENCY OF THYMINE GENE REVERSION OF STRAIN ESCHERICHIA COLI K-12 3.OSO. Laurinaviciene, D. (Inst. of Botany, Riga). Liet. TSR Moksl u Akad. Darbai, Ser. C; 4: No. 68, 127-131(1974). (In Russian).

The reversion rate of thymine gene (spontaneous and induced by uv-light) was found to be greater in Hfr strain than in the F^+ and F^- strain, the direct correlation between frequency of reversion occurence in thymine gene and the intensity of protein biosynthesis being established as well. Low temperature (25°C) stimulated reversions in the F^+ and F^- strains. (auth)

11706 STUDIES ON NATURAL PHOTO-PROTECTORS. III. Radioresistance of Mutants of Aspergillus Giganteus (Wehm.) With Various Photosensitivity. Lazarski, R. (Agricultural Coll., Krakow). Folia Biol. (Krakow); 23: No. 2, 129-134(1975).

The radiosensitivity of Aspergillus giganteus (Wehm.) mutants with various resistance to light related to carotenoid content was investigated. The size of lethal doses and growth delay under the influence of 20 kR doses was taken as the criterion. Changes in radiosensitivity in the course of development were also studied. No relation between photosensitivity and radiosensitivity was found. (auth)

11707 GENETIC CONTROL OF THE BIOSYNTHESIS OF NICOTINIC ACID IN RHODOTORULA GLUTINIS. Samsonova, I. A.; Boettcher, F.; Birnbaum, D. (Univ., Greifswald, Ger.). Genetika; 11: No. 4, 134-141(Apr 1975). (In Russian).

In the yeast Rhodotorula glutinis the biosynthesis of nicotinic acid from tryptophan is blocked, with a relatively high frequency, by uv light and nitrosoguanidine (NG) induced mutations. Approximately 10% of all auxotrophs with a blocked biosynthesis of amino acids, pyrimidines, purines, or vitamins are Nic^- mutants. In a random sample of 49 independently arisen Nic^- mutants, the genetic blocks were studied by means of syntrophism and complementation tests, feeding experiments with different metabolites, and the analysis of substances accumulated in the culture medium. UV- and NG-induced mutations were observed to inactivate the tryptophan pyrrolase (Nic I), the kynurenine hydroxylase (Nic II), the 3-hydroxykynureninase (Nic III), and to block two reactions in the pathway from 3-hydroxyanthranilic acid to nicotinic acid, probably the catalytic action of the 3-hydroxyanthranilate oxydase (Nic IV) and the cyclization of the pyridine cycle (Nic V). The transformation of N'-formylkynurenine to kynurenine, catalyzed by the kynurenine formamidase, is not blocked by mutations. In difference to the approximately equal distribution of the NG-induced mutants among the genetic blocks, UV-induced mutations, which inactivated the catalytic function, occurred with a significantly higher frequency in the genes of the tryptophan pyrrolase and the 3-hydroxykynureninase than in the genes of the other enzymes of the tryptophan-nicotinic acid pathway. Interallelic complementation, which was tested between the Nic II and the Nic V mutants, occurred in both cases. (auth)

11708 DOUBLE MUTANTS FOR ade2 LOCUS IN YEAST SACCHAROMYCES CEREVISIAE AND THEIR UTILIZATION IN INTRAGENIC MAPPING. Inge-Vechtomov, S. G.; Gordenin, D. A.; Kvasha, V. V. (Zhdanov State Univ., Leningrad). Genetika; 11: No. 4, 121-133(Apr 1975). (In Russian).

A method of obtaining double mutants for ade2 locus in yeast was developed. The essence of the method is a mutational change of suppressible alleles into non-suppressible ones. Nineteen alleles of ade2 proved to be double mutant ones according to the change of their revertibility, complementation, and recombination patterns of original suppressible alleles. Genetic region included between two mutations of double mutant alleles is being referred to as a marked region. Qualitative test for mitotic recombination induced with uv-light in three- and four point crosses permitted to figure out overlapping relations between marked regions. Projection of marked regions on the linear map divided the ade2 gene into nine controlled segments. Crosses of a single mutant with the series of double mutants obtained permits one to determine position on the mutational site at one of the nine controlled regions. A location of 11 earlier mapped ade2 mutants is specified. The data obtained show that the method described can be used when studying a fine structure of ade2 gene. (auth)

11709 LIQUID HOLDING RECOVERY OF UV- OR X-IRRADIATED CONIDIA OF UVS^+ AND UVS STRAINS OF ASPERGILLUS NIDULANS. Muronets, E. M.; Kameneva, S. V. (Moscow State Univ.). Genetika; 11: No. 4, 106-114(Apr 1975). (In Russian).

Elimination of lethal damages in the process of liquid holding recovery (LHR), induced by uv- or x irradiation in uvs^+ and uvs strains of Aspergillus nidulans is studied. Incubation of uv- and x-irradiated uvs^+ conidia in buffer resulted in 4-fold increase in viability (LHR effect). In two uvs mutants, which were similar to bacterial rec mutants in a number of characteristics, LHR was similar to that of the wild strain; no LHR effect was observed in uvs mutant of the uvr type. It is found that DNA synthesis is retarded, while RNA synthesis and protein synthesis are intact under incubation of conidia in buffer. Actidione (40 μg/ml) and acryflavine (1 μg/ml, which did not affect DNA and protein synthesis), added in buffer after the irradiation, inhibited protein synthesis and eliminated the LHR effect. It suggests that LHR effect in Asp. nidulans is due to the function of a system of dark reparation. (auth)

11710 RADIATION RESISTANCE OF SPORES OF SOME CLOSTRIDIUM PERFRINGENS STRAINS. Clifford, W. J.; Anellis, A. (Army Natick Labs., Natick, MA). Appl. Microbiol.; 29: No. 6, 861-863(Jun 1975).

Clostridium perfringens spores (eight strains) were irradiated in a model system with ^{60}Co gamma rays at -30°C. The quantal response data obtained were analyzed with extreme value statistics. It was found (at the 95 percent confidence level) that all eight strains followed the same rate of death and that this rate was probably (at the 95 percent level) not exponential. The statistics did not exclude, however, a normal, lognormal, Weibull, or related rate of spore kill. A more definitive study would be required to distinguish between the latter distributions. (auth)

11711 EFFECT OF GAMMA-IRRADIATION ON RED GRAM (CAJANUS CAJAN) PROTEINS. Nene, S. P.; Vakil, U. K.; Sreenivasan, A. (Bhabha Atomic Research Centre, Bombay). J. Food Sci.; 40: No. 4, 815-819(1975).

The effect of radiation processing on red gram proteins has been studied. Total proteins and amino acid profiles are not appreciably changed, but an overall increase of about 15 percent in free amino acid levels has been observed in irradiated (1 Mrad) samples. Studies on stepwise in vitro digestibility by pepsin, trypsin, and erepsin indicate increased susceptibility of irradiated red gram proteins to enzyme action. This can be attributed to the degradation of proteins to smaller molecular weight entities. Red gram trypsin inhibitor exhibits high thermostability and radioresistance up to 3 Mrad dose levels. (auth)

Radiation Effects on Plants

Refer also to abstracts 11685 and 11760.

11712 RADIORESTORATION BY s-RNA EXTRACTS FROM YEAST AND A MIXTURE OF THEIR NUCLEOTIDES ON THE GROWTH OF SCORSONERA CROWN-GALL TISSUE IN VITRO. Jonard, R.; Ravelomanana, D. (Montpellier-2 Univ., 34 (France)). C. R., Ser. D.; 280: No. 6, 803-805(10 Feb 1975). (In French).

Transfer RNA extracts from yeast restore the growth of Scorsonere Crown gall tissues which were subjected to gamma radiation from Cobalt-60. A mixture of nucleotides obtained from enzymatic hydrolysis of s-RNA by a ribonuclease T_1 has the same stimulatory effect. (FR)

11713 PARTIAL SUPPRESSION BY UV IRRADIATION OF THE MECHANISM OF RESISTANCE TO CUCUMBER MOSAIC VIRUS IN A RESISTANT CUCUMBER CULTIVAR. Levy, A.; Loebenstein, G.; Smookler, M.; Drori, T. (Volcani Center, Bet Dagan, Israel). Virology; 60: No. 1, 34-44(Jul 1974).

Shortwave uv (2540 A) significantly enhanced cucumber mosaic virus (CMV) multiplication in cotyledons of a resistant cucumber (Cucumis sativus L.) cultivar (Elem) when applied 1 to 3 days after inoculation. Compared with nonirradiated controls, infectivity increased 4 to 8 times when cotyledons were irradiated with dosages of 11,000 to 18,000 ergs mm^{-2} at a distance of 10 cm, 1 to 2 days after inoculation. Irradiations after longer intervals were less effective and irradiations with longwave uv (3600 A) had no effect. Irradiations before inoculation reduced extractable infectivity markedly. No difference in infectivity titer was obtained when cotyledons of a susceptible cucumber variety were irradiated. The number of virions, observed with an electron microscope, in extracts of cotyledons irradiated 48 hr after inoculation, was also significantly higher than in control extracts. The action spectrum for the suppression of the resistance (dose scale factor of 28 to 42) was between that of tobacco mosaic virus (TMV) (40 to 60) and that of TMV-RNA (15 to 20), used as biological dosimeters for nucleoproteins and nucleic acids, respectively, and differed markedly from that of a protein (4 to 5). It is suggested that the resistance mechanism is activated by the virus, and suppressed by shortwave uv, which probably blocks transcription by the formation of thymine dimers. (auth)

11714 MODIFICATION OF THE EFFECT OF UV IRRADIATION ON PINE POLLEN BY ISOLATED CELL CONSTITUENTS. Relation to Radiation Stimulation. Zelles, L.; Ernst, D. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Hannover (F. R. Germany). Inst. fuer Strahlenbotanik; Technische Univ. Hannover (F. R. Germany). Inst. fuer Biophysik). Radiat. Environ. Biophys.; 11: No. 4, 271-280(Mar 1975). (In German).

The effect of uv irradiation on the growth of pine pollen tubes can be modified by isolated fractions of cell extracts, especially by a fraction containing the cell wall material. Cell extracts irradiated with high uv doses also stimulate the tube growth of unirradiated pollen grains. RNA, flavonoles, and high-energy compounds (ATP, GTP, and UTP) did not show any effect concerning tube growth stimulation. Some amino acids modified the tube growth of unirradiated pollen grains, while hydroxyproline, threonine, alanine, glutamic acid, proline, and valine stimulated the tube growth. Cysteine, histidine, lysine, tryptophan, and glutamine inhibit it. Ultraviolet irradiation of the basic amino acids (i.e., lysine, arginine, and histidine) increased, whereas irradiation of cysteine, glycine, tyrosine, and isoleucine additionally decreased the tube growth. (auth)

11715 MODIFICATION OF CHROMOSOME ABERRATION FREQUENCY IN MITOSIS. Lebedeva, L. I.; Chubykin, V. L. (Inst. of Cytology and Genetics, Novosibirsk, USSR). Genetika; 11: No. 4, 30-36(Apr 1975). (In Russian).

Gamma irradiation of pea seedlings that have developed from irradiated or aging seeds may result in the decrease of the rate of chromosome structural mutations in the meristematic cells of root tips. This effect is observed in 7 to 9 min. after the treatment. It depends on the type of mutagenic and modifying radiation. This effect is noted only in those aberrations whose formation is assumed to be not completed by the beginning of metaphase. The rate of spontaneous aberrations in the seedlings of young seeds is not modified by gamma irradiation. The modifying effect is not related to the sticking of centric and acentric chromosome fragments and is also not to bring breaks at anaphase. It is suggested that this effect is not related to the death of aberrant cells, nor to changed duration of mitotic stages because the values of the metaphase induces do not change within the first 10 min. after the irradiation. It is possible that modifying irradiation prevents the ultimate realization of chromosome aberrations by inhibiting the processes of aberration realization, by stimulating reparative processes or altering the nature of premutational potential chromosome damages. However, to elucidate the mechanisms of the effect observed the additional experimental checking of cell viability and of the duration of mitotic stages during the first 10 min. after the irradiation is needed. (auth)

11716 BIOLOGICAL EFFECT OF AN INCREASED LEVEL OF IONIZING RADIATION AND THE PROCESSES OF RADIOADAPTATION IN POPULATIONS OF HERBACEOUS PLANTS. Cherezhanova, L. V.; Aleksakhin, R. M. (Inst. of General Genetics, Moscow). Zh. Obshch. Biol.; 36: No. 2, 303-311(1975). (In Russian).

Changes of radiosensitivity of herbaceous plant populations growing for a long time on plots experimentally polluted with ^{90}Sr were investigated. The radiosensitivity values of 18 plant species estimated by the number of chromosome aberrations in the leaf meristem cells of gamma-irradiated young plants have been found to be inversely proportional to the interphase chromosome volume (ICV). A long-term action of ^{90}Sr (the content in the soil 0.3 to 3.7 mCu/m^2) resulted in an increase of plant radioresistance manifesting itself in the reduction of chromosome aberration rate after additional gamma irradiation of seeds and plants from the ^{90}Sr-polluted plots. An increase of the mitotic activity and a rise of the germinated seed amount after additional gamma irradiation was observed on ^{90}Sr-polluted plot. The increase of radioresistance due to a prolonged effect of ^{90}Sr was more pronounced in plant species with a higher radiosensitivity. The cytogenetical effect of ethyleneamine treatment proved to be less in plants growing on ^{90}Sr polluted plots, i.e., an increase in radioresistance was associated with a higher resistance to the effect of chemical mutagens. The conclusion is made of a radioadaptation property in herbaceous plant populations which exist under conditions of an increased level of ionizing radiation for many years. (auth)

11717 EFFECT OF GAMMA IRRADIATION OF SEEDS ON SOME MORPHOLOGICAL CHARACTERS AND SEX EXPRESSION IN MUSKMELON (CUCUMIS MELO L.). Bisaria, A. K.; Kaushik, M. P.; Sharma, J. K.; Singh, I. (D. A. V. Coll., Muzaffarnagar, India). Curr. Sci. (India); 44: No. 11, 392-394(5 Jun 1975).

Studies were undertaken to elucidate the effect of γ irradiation of seeds on length of vine, nodes, lateral branches, sex expression, and pollen sterility in Cucumis melo L. Seeds were irradiated at doses of 0.5, 1.0, 1.5, 2.0, and 2.5 kR from a ^{60}Co source at a dose rate of 2100 R/min in air. Irradiation of seeds increased the length of vines, the number of nodes, and lateral branches up to 1 kR. At higher doses, these factors decreased. Irradiation up to 1.5 kR increased the number of hermaphrodite flowers, 2.0 kR had no significant effect, and 2.5 kR reduced it drastically. Number of staminate flowers decreased progressively with increase in dose. Pollen sterility increased gradually with dose. (ERB)

11718 SOME OBSERVATIONS OF GAMMA IRRADIATION ON GROWTH AND FLOWERING OF TUBEROSE BULBS. Patil, A. V.; Kale, P. N.; Kaulgud, S. N. (Mahatma Phule Krishi Vidyapeeth, Ahmednagar, India). Curr. Sci. (India); 44: No. 11, 406-407(5 Jun 1975).

Bulbs of single tuberose were irradiated at doses of 0.5, 2.5, and 3.5 kR. One desirable mutant was obtained at the 0.5 kR dose. Higher doses were more or less lethal for sprouting tuberose bulbs. (ERB)

11719 BREAKING DORMANCY IN COCKLEBUR (XANTHIUM STRAMONIUM) SEEDS WITH GAMMA RADIATION, TEMPERATURE, AND LIGHT TREATMENTS. Mathew, T.; Gaur, B. K. (Bhabha Atomic Energy Research Centre, Bombay). Indian. J. Exp. Biol.; 13: No. 1, 45-48(Jan 1975).

Effect of gamma radiation, light, and high temperature (30 and 37°C as compared to 25°C) was studied singly and in combination on the germination of dormant seeds of X stramonium. While any one of the three treatments could break dormancy, gamma radiation proved most effective. Germination of irradiated seeds in light at 25°C or in dark at 30 or 37°C exhibited synergism between radiation and light as well as radiation and high temperatures. The latter combination, however, resulted in antagonism as germination advanced. (auth)

Radiation Effects on Animals

Man

Refer also to abstracts 11527, 11528, 11548, 11683, 11826, and 11895.

11720 (ANL-75-3(Pt.2), pp 90-92) X-RAY EXPOSURES GIVEN WITH VARIOUS COMBINATIONS OF FILM AND SCREEN. Schlenker, R. A.; Kirsh, I. E. [nd].

In Radiological and Environmental Research Division annual report, July 1973-June 1974. (Argonne National Lab., Ill. (USA)).

A comparison of entrance exposure doses of patients for various film and screen combinations and xeroradiographs showed that moderate speed screen and film gave exposures 4 to 7 times greater than fast film and screen and that xeroradiographs pro-

duced exposures 20 to 40 times greater than fast film and screen. Xeroradiographs produced table top incident exposures which exceeded Illinois Department of Health limits, while conventional film-screen combinations did not. (auth)

11721 (ANL-75-3(Pt.2), pp 117-120) RADIUM-226 CONTENT AND EMANATING POWER OF SOME TIMEPIECES MANUFACTURED IN THE YEARS 1926–1951. Keane, A. T.; Huff, D. R. [nd].

In Radiological and Environmental Research Division annual report, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

Thirty-two radium-dial timepieces manufactured in the years 1926 to 1951 by a company in Connecticut were individually sealed in small steel cans for determination of radium-C (^{214}Bi) activity by gamma-ray spectroscopy. Each can was counted within a few hours after sealing and again 5 or 6 days later; from the two observations, radium-C activities at time of sealing (nonemanating radium content) and at equilibrium (total radium content) were calculated. The mean radium-226 content of 22 pocket watches was 348 nCi (range, 159 to 606), and the mean emanating power (1-nonemanating Ra/total Ra) was 0.175 (range, 0.09 to 0.33). The mean radium-226 content of 9 wrist watches was 150 nCi (range, 54 to 449), and the mean emanating power was 0.242 (range, 0.12 to 0.34). The radium-226 content of the one small clock was 633 nCi, and its emanating power was 0.15. The concentration of radon-222 in the air of a sealed room of dimensions 3 x 3 x 3 m would be increased by about 3 pCi/l if a watch containing 400 nCi of radium-226 with an emanating power of 0.2 were left in the room for a few weeks. (auth)

11722 (CONF-740369-) PROCEEDINGS OF THE SYMPOSIUM ON BIOLOGICAL APPROACH TO PROBLEMS IN MEDICINE, INDUSTRY, AND AGRICULTURE, BOMBAY, INDIA, MARCH 12–14, 1974. (Department of Atomic Energy, Bombay (India). Biology and Medical Committee). 1974. 396p.

A separate abstract was prepared for one paper. An additional 38 papers were presented on various aspects of biology, medicine, industry, and agriculture. (HLW)

For an abstract of an individual paper see: 11688.

11723 (CONF-741230-3) COMPARISON OF IMAGE QUALITY IN OPTICAL AND RADIOGRAPHIC MAGNIFICATION TECHNIQUES FOR FINE-DETAIL SKELETAL RADIOGRAPHY: EFFECT OF OBJECT THICKNESS. Doi, K.; Genant, H. K.; Rossmann, K. (Chicago Univ., Ill. (USA). Dept of Radiology). 1974. 31p. Dep. NTIS $4.75.

From Radiological Society of North American Conference; Chicago, Illinois, USA (1 Dec 1974).

High-resolution radiography for skeletal image may be done with optical or radiographic magnification procedures. The imaging properties of these two high-resolution techniques are evaluated. (CH)

11724 RADIOACTIVE RELICS. Linsley, G. S. (National Radiological Protection Board, Harwell, Eng.). Radiol. Prot. Bull.; No. 11, 19-21(Apr 1975).

Luminous devices incorporating radium have been in common military and civilian use since the 1914 to 1918 war, and in addition there have been medical applications of radium in radiotherapy and early treatments involving the administration of radium solutions. The initial lack of government control over the acquisition and disposal of radioactive material has had the result that old radium devices are still being rediscovered today, sometimes by unsuspecting members of the public. Amateur divers have been retrieving as souvenirs perspex marker discs each containing 25 μCi of radium-226 from the wreck of a ship torpedoed in the Channel in 1945. A recovery operation aimed at removing all the remaining discs is regarded as being hazardous and difficult, and amateur divers have been warned against removing the discs. Watch and clock dials were luminized with a radium-226 compound until the 1960s, and there is one recorded instance of a child having ingested radium after chewing an old watch. Radioactive material was discovered in a cardboard box in a hospital basement room used for document storage. A broken glass phial had spread contamination over floors and clothing before the hazard was identified. The combined effects of the Radioactive Substances Act 1960, Factories Act 1961, and the complementary codes of practice are now reducing the possibility of similar accidents occurring in future. In addition the proposed European statuatory controls over the domestic use of "miscellaneous sources", such as luminous devices will require the granting of prior approval for any such use of radioactive material. (UK)

11725 RADIOACTIVITY AND THE LIFE SCIENCES. Hornsey, D. J. London; Methuen Educational Ltd. (1974). 93p.

A general review of the biological and medical effects of radiation is preceded by a basic description of the physics of radioactive decay processes. The hazards and health aspects of radioactivity are treated historically; consideration is given to the recent controversies over nuclear power programmes, nuclear weapons testing, and environmental waste disposal. Selected topics in nuclear medicine, including the use of isotope generators in the preparation of radiopharmaceuticals and their use in radiodiagnosis, and high energy particle beams for radiotherapy, are examined. The review of applications in biological research is intended to demonstrate the versatility of the radioisotope and the radiation source in this field. (UK)

11726 SPERMATOGENESIS ALTERATION DURING PROTRACTED IRRADIATION IN MAN. Popescu, H. I.; Lancranjan, I. (Academia de Stiinte Medicale, Bucharest). Health Phys.; 28: No. 5, 567-573(May 1975).

A total of 72 persons with long-term occupational exposure to ionizing radiations were subjected to an andrologic examination including semen analyses. The investigated subjects had not had any gonadic disease or other diseases which could induce spermatogenesis troubles. Semen specimens were compared with those of 42 controls of a similar mean age. The examination of spermatic liquid revealed hypospermia in 45.8%, asthenospermia in 68%, and teratospermia in 75% of the investigated subjects. The incidence of these spermatogenesis alterations significantly differed from those of the controls. Parvisemia was not different between the exposed and control group even at a 5% threshold. Using the present day accepted criteria for defining hypofertility and infertility, there are significant differences between the exposed and control groups as regards the incidence of hypofertility and infertility ($P < 0.05$). The spermatogenesis alterations –especially hypospermia and teratospermia–noticed in protracted irradiation can account for lowering of fertility of men occupationally exposed to ionizing radiations, previously proved by epidemiologic researches carried out in various countries. As semen of poor quality is known to be associated with spontaneous abortions and stillbirths, and because these were also more frequently found in families of men occupationally exposed to ionizing radiations, the present data bring supplementary and direct evidence in favor of a relationship between these dominant lethalities and long-term exposure to ionizing radiations. (auth)

11727 FETAL HYPOTHYROIDISM DUE TO TREATMENT OF THE MOTHER WITH IODINE-131 DURING PREGNANCY. Battin, J.; Hebunstre, J. P.; Azanza, X.; Sainz, J. M. (Hospital des Enfants, 33 - Bordeaux (France)). Ann. Pediatr.; 51: No. 2, 147-153(2 Feb 1975). (In French).

Although formally contra-indicated in these cases, iodine-131 is occasionally administered to women in whom pregnancy was unsuspected. A case in which 50 millicuries were administered for carcinoma of the thyroid, two and a half months after the beginning of pregnancy is reported. The child showed myxoedema from birth and, in spite of thyroid hormone, which was administered immediately, remained severely mentally deficient. This case, similar to those in the literature, proves the importance of the role of fetal thyroid in the development of the brain. Clinical analysis is compared with experimental data concerning the uptake of radioactive iodine by the fetal thyroid. It thus appears that the destruction of the fetal thyroid is all the more likely to occur when the dose of iodine-131 is higher, when the latter is administered from the second month onwards, and when maternal thyroid function is deficient. Owing to the possible passage of thyroid hormones across the placenta, administration of thyroid hormones in the mother may prevent the consequences of the destruction of the fetal thyroid. (FR)

11728 RADIOLOGICAL PRACTICE IN HIROSHIMA AND NAGASAKI. Trends from 1964 to 1970. Sawada, S.; Fujita, S.; Russell, W. J.; Takeshita, K. (Atomic Bomb Casualty Commission, Hiroshima and Nagasaki, Japan). Am. J. Public Health; 65: No. 6, 622-633(Jun 1975).

Use of medical x ray in Hiroshima and Nagasaki from 1964 to 1970 was assessed according to numbers of films consumed, and the radiographic, fluoroscopic, and photofluorographic examinations performed. Except for chest photofluorography, a steady increase in the use of medical x ray since World War II is demonstrated. (auth)

11729 RECTAL COMPLICATIONS IN THE RADIATION TREATMENT OF CANCER CERVIX. Bose, A. K.; Kapoor, H. K. (MA Medical Coll., New Delhi). Indian J. Radiol.; 27: No. 2, 140-143(1973).

Seventy-nine cases of stage I to III cancer of the cervix were treated by Manchester technique intra-cavitary cobalt 60, and supplementary parameterial external cobalt treatment. They had consequent full rectal dose measurement by Siemens gammameter apparatus. The results have been evaluated in terms of complications particularly of the rectal variety. Correlation of

rectal reactions/complications, with reference to uterine position and rectal dose received, has been discussed. (Indian Sci. Abstr.)

11730 PRACTICAL CALCULATION METHOD OF THE DISTRIBUTION FUNCTION OF THE RISK ADDED BY IRRADIATION. Wolber, G. (Electricite de France, Paris). Trans. Am. Nucl. Soc.; 21: 87(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11731 MEASUREMENT OF ENERGY DEPOSITION OF NEUTRONS IN A HETEROGENEOUS PHANTOM. Smith, L. A. (Babcock and Wilcox Co., Lynchburgh, VA); Bull, S. R. Trans. Am. Nucl. Soc.; 21: 112(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11732 CHANGES IN THE PERIPHERAL LEUKEMIC LYMPHOCYTES DURING RADIOTHERAPY, AND THE CLINICAL SYMPTOMS PRODUCED BY THE INDIRECT EFFECTS OF IRRADIATION. Fodor, J. (Orszagos Onkologiai Intezet, Budapest (Hungary)). Strahlentherapie; 149: No. 2, 162-165(1975). (In German).

Leukemic lymphocytes are much more sensitive even to local irradiation than non-leukemic ones. The substantial drop in the number of lymphocytes is partly due to indirect radiobiological effects. It appears likely that the antigens liberated by the damaged tumor cells under the action of radiation augment immunoreaction thus causing additional pathological cells to be destroyed (radioinduced immune processes). (auth)

11733 TREATMENT AND RESULTS OF THE PRIMARY IRRADIATED CARCINOMA OF THE CERVIX UTERI IN THE YEARS 1966 TO 1968. Hernuss, P.; Weghaupt, K. (Vienna Univ. (Austria). Strahlenabteilung). Strahlentherapie; 149: No. 3, 247-251(Mar 1975). (In German).

This is a report about 422 patients with a carcinoma of the cervix uteri, who underwent a primary radiotherapeutic treatment in the period from 1966 to 1968. 342 (77.4 %) were at the age between fifty and seventy years. 226 (60%) of the women were in the stages III and IV. A five-years-healing could be obtained with 234 patients (45%). Nobody died in consequence of the treatment, i.e., primarily. 34 (7.6%) died intercurrently. A rectovaginal fistula appeared on 10 women (2.2%). No vesicovaginal fistula was observed. 58 women (13%) suffered from an alimentary diabetes. It is determined that this grouping represents a negative selection of patients as the stages I and II have been operated according to Wertheim, if no contraindication for the operation was existent; for that reason, the intercurrent rate of mortality in the stage I was relatively high. (auth)

11734 RESULTS OF COBALT-60 IRRADIATION OF TUMORS OF THE BRAIN. Seyfeddinipur, N.; Gutjahr, P.; Kutzner, J. (Mainz Univ. (F. R. Germany). Neuro-Psychiatrische Klinik; Mainz Univ. (F. R. Germany). Kinderklinik; Mainz Univ. (F. R. Germany). Inst. fuer Klinische Strahlenkunde). Strahlentherapie; 149: No. 3, 241-246(Mar 1975). (In German).

The periods of survival which can be obtained on patients with a primary tumor of the brain after a unique or postoperative cobalt-60 irradiation is dependent on the histology. While periods of survival of several years have been obtained in case of medulloblastoma and astrocytoma, the irradiation of the multiform glioblastoma represents only a palliative measure with a temporary amelioration for any months. (auth)

11735 ABOUT THE RADIOTHERAPY OF TUMORS OF THE ESOPHAGUS. Wahlers, B.; von Koppenfels, R. (Muenster Univ. (F. R. Germany). Radiologische Klinik). Strahlentherapie; 149: No. 3, 252-261(Mar 1975). (In German).

This is a report about experiences on 205 patients with malignant tumors of the esophagus in the years 1960 to 1974 who have been submitted to a primary or post-operative high voltage therapy. The periods of survival have been studied with regard to the age, localization of the tumor, growth of the tumor, and different therapy and compared with the data of the world literature. (auth)

11736 HARD X-RAY THERAPY WITH PARTICULAR REGARD TO THE POSTOPERATIVE IRRADIATION OF THE CANCER OF THE BREAST. Hofmann, H. G. (Kreiskrankenhaus Buchholz (F. R. Germany). Radiologische Abt.). Strahlentherapie; 149: No. 3, 267-275(Mar 1975). (In German).

Five-year-experiences have shown that a considerably intensified tolerance of the skin and an absorption equability of tissues of bones and muscles are obtained with the hard ray roentgen irradiator, RT 305, for half-value depths from 20 mm to 70 mm H_2O and half-value thicknesses to about 7 mm Cu. By means of a rod anode tube of 300 kV with a super-normal filtration to 3.5 mm Pb, a hard and nearly monochromatic radiation, which already possesses the above mentioned advantages of the ultrahard ray therapy with an effective energy about 0.2 MeV, appears. The application of this hard ray therapy is given preferably for disease foci in the environment of bone tissues, i.e., in the head and throat, the vertebral column, the osseous pelvic ring and the extremities and as the conventional roentgen therapy is not able to give it. The hard ray therapy seems to be particularly adapted for the postoperative irradiation of the cancer of the breast with the ribs lying in the region of the irradiation fields, with the sternum and the bones of the shoulder girdle. With regard to these radiotherapeutic possibilities, corresponding cases are demonstrated. (auth)

11737 INVESTIGATION OF IMMUNOGLOBULIN (IgG, IgA, IgM) LEVELS IN THE BLOOD SERUM OF URANIUM MINERS AFTER HIGHER AND LOWER EXPOSURE TO IONIZING RADIATION. Andrlikova, J.; Wagner, V.; Palek, V. (Zavodni Ustav Narodniho Zdravi Uranoveho Prumyslu, Pribram (Czechoslovakia)). Strahlentherapie; 149: No. 2, 212-218(1975).

The levels of IgG, IgA, and IgM were measured in the blood serum of uranium miners in a mining-district, where after a geological disturbance exposure to a high level of ionizing radiation took place. The mean exposure to ^{222}Rn daughters after first year was 7.35 WLM, after the second year 0.13 WLM only. Serum was sampled before miners started their occupation, for the second time after the first year and for the third time after the second year. The levels of IgG and IgM significantly decreased after one year of exposure, while the IgA changed only slightly. After the second year the level of IgG and IgM significantly rose. IgG exceeded the initial levels: A regenerative hypercompensation took place. On the other hand IgA at the same time decreased. The IgG levels are only slightly correlated with radiation dose rate; for IgA and IgM the correlation is lacking. Individual Ig levels appear to be very variable. The reduction of IgG reached hypogammaglobulinemic levels in some miners after the first year and was followed by a propensity to infections of the respiratory tract. The significance of these observations is discussed from the immunological, radiological, and radiohygienical point of view. (auth)

11738 APPLICATION OF ACIDOPHILUS CREME IN IRRADIATION. Tomic-Karovic, K.; Rudez, V. (Sredisnji Institut za Tumore i Slicne Bolesti, Zagreb). Bull. Sci., Sect. A; 20: No. 3/4, 72-74(1975).

The prophylactic and therapeutic efficacy of acidophilus creme, prepared from milk fermented by Lactobacillus acidophilus, was tested in patients undergoing electron radiotherapy. The preparation was demonstrated to be effective in preventing the occurrence of skin defects when applied prior to irradiation, and also effective in the treatment of radioinduced skin ulcerations. (ERB)

11739 EFFECT OF IRRADIATION AND VINBLASTINE ADMINISTRATION ON FREE α-AMINO NITROGEN CHANGES IN PLASMA, ERYTHROCYTE, AND LEUKOCYTE. Lal, H.; Agarwal, K. N. (Banaras Hindu Univ., India). Indian J. Exp. Biol.; 13: No. 1, 71-73(Jan 1975).

The free α-amino nitrogen concentrations in plasma and erythrocyte were significantly lowered, whereas leukocyte showed a marked increase after the localized irradiation or vinblastine administration. Irradiation also induced a fall in total plasma proteins and albumin concentrations, whereas the administration of vinblastine was associated with highly significant polymorphonuclear neutropenia. (auth)

11740 ACUTE MYELOGENOUS LEUKEMIA FOLLOWING FALLOUT RADIATION EXPOSURE. Conard, R. A. (Brookhaven National Lab., Upton, NY). J. Am. Med. Assoc.; 232: No. 13, 1356-1357(30 Jun 1975).

Acute myelogenous leukemia developed in a 19-year-old Marshallese man exposed to radioactive fallout at 1 year of age. He was accidentally exposed in 1954 following the testing of an atomic device on Bikini atoll 100 miles away. Internal absorption of radionuclides from inhalation and consumption of contaminated food and water produced no acute effects, but absorption of radioactive iodine resulted in later development of thyroid lesions in one third of the population of 64; three of these lesions were malignant. The highest incidence was in children exposed at less than 10 years of age, some of whom had growth retardation. Although the occurrence of one case of leukemia in this population is not statistically strong evidence of radiation as its cause, it must be considered. The greater effect of radiation exposure on the myelocytes of this patient is interesting in view of the later development of the myelocytic form of leukemia. Morphologic changes in the myelocytes were not apparent as late as one year before the development of the illness. The thrombocytic and erythrocytic elements did not show evidence of abnormality until near death. Neutrophilic depression was the only evidence of a possible preleukemic syndrome that has been described in some cases of this disease. The frequency of infections that occur in the Marshallese environment may have played a role in the development of a possible radiation-induced mutant clone. (ERB)

Vertebrates

Refer also to abstract 11894.

11741 (COO-3017-18) PARABIOSIS, RADIATION AND CARCINOGENESIS IN THE RAT. Warren, S.; Brown, C. E.; Chute, R. N. (New England Deaconess Hospital, Boston, Mass. (USA). Cancer Research Inst.). 23 Oct 1974. Contract AT(11-1)-AT(11-1)-3017. 9p. (CONF-741034-5). Dep. NTIS $4.00.

From 11th international cancer congress; Florence, Italy (20 Oct 1974).

Parabiosis extended the survival time of rats exposed to 1000 R of x radiation when the partner was shielded and enabled the appraisal of radiation carcinogenesis following application of a radiation dose normally in the lethal range. The incidence of leukemia, breast cancer in females, and osteogenic sarcoma in irradiated parabionts was compared with that of their shielded partners. Results showed that irradiated partners not only developed more tumors by 300 to 900 days post-irradiation but developed tumors about two months earlier than either their partners or other control animals and many irradiated animals developed multiple tumors. (CH)

11742 COMPARISON OF THE LETHAL EFFECTS CAUSED BY 645 MeV HELIONS AND γ RAYS ON CANCEROUS CELLS IN MICE. Guichard, M.; Malaise, E. (Institut Gustave Roussy, 94 - Villejuif (France)). C. R., Ser. D.; 279: No. 25, 1959-1962(16 Dec 1974). (In French).

Survival and repair of potentially lethal lesions of the EMT 6 cell were compared after irradiation with 645 MeV helions or cobalt 60 γ rays. The helions produce less sublethal lesions but the kinetics and amplitude of the repair of potentially lethal lesions are comparable in the two cases. (FR)

11743 STUDY OF THE INFLUENCE OF VARIOUS NITROGENATED HETEROCYCLES ON THE SURVIVAL OF MICE EXPOSED TO A LETHAL DOSE OF γ RAYS. Mourret, A.; Agnius-Delord, C.; Martinet, C.; Rinaldi, R. (Grenoble-1 Univ., 38 (France). Inst. des Isotopes Radioactifs). C. R., Ser. D.; 279: No. 25, 1963-1966(16 Dec 1974). (In French).

In the context of research on new chemical radioprotection agents and results obtained with 29 derivatives of imidazole and benzimidazole, naphthalene and one of its derivatives and ethydium bromide are reported. All these substances are administered to male and female mice exposed to 1100 R(LD 100/30) of ^{60}Co γ rays. Sixteen of these substances are moderately radioprotective (30 to 70% survival according to the sex of the animal) and five others very active (70 to 100%), especially naphazoline which when studied in more detail showed a 100% survival even when administered in very small doses. (FR)

11744 IMMUNE RESPONSE OF MICE TREATED WITH ANTI-mu ANTIBODIES: THE EFFECT ON ANTIBODY-FORMING CELLS, THEIR PRECURSORS AND HELPER CELLS ASSAYED IN VITRO. Gordon, J.; Murgita, R. A.; Tomasi, T. B. Jr. (Mayo Medical School, Rochester, MN). J. Immunol.; 114: No. 6, 1808-1812 (Jun 1975).

Previous studies showed that mice treated from birth with heterologous anti-mu antiserum are severely immunosuppressed with respect to numbers of splenic plaque-forming cells (PFC) to sheep red blood cells (SRBC) in all immunoglobulin classes. A study was made, using in vitro techniques, of the cellular site of the deficit created by anti-mu. The primary PFC response of spleen cells originating from anti-mu-treated mice was completely suppressed in vitro. The response was restored by the addition to the cultures of B cells but not T cells. T cells were derived from normal spleens depleted of B lymphocytes and adherent cells by filtration through cotton wool columns, or by educated thymus cells obtained from the spleens of lethally irradiated mice injected with syngeneic thymocytes and SRBC. Restoration of the PFC response of spleen cells from anti-mu-treated mice by normal B cells suggested that a cellular deficiency rather than an activity process by inhibitory cells was the cause of the immunosuppression. Also, co-culturing spleen cells from normal and suppressed mice did not reveal the presence of inhibitory cells. Spleen cells from x-irradiated mice, injected with bone marrow from anti-mu-suppressed mice, gave rise to PFC cells when cultured with SRBC and normal T cells, suggesting that stem cells giving rise to B cells were not affected by anti-mu-treatment. Similarly, educated thymus cells derived from suppressed mice could provide helper function when reconstituted in vitro with normal B cells. Exposure of normal bone marrow and spleen cells to anti-mu serum prior to passage through syngeneic x-irradiated recipients demonstrated that spleen cells were much more sensitive than were bone marrow cells to suppression by anti-mu antibodies. It is concluded that the target of anti-mu antibody is a mu-chain bearing B cell precursor to the IgM-, IgG-, and IgA-producing cell. (auth)

11745 USE OF TRASYLOL-AMINOCAPROIC ACID AND DIMETHYLSULFOXIDE FOR PREVENTION OF RADIATION LESIONS OF THE SKIN. Gaponyuk, P. Ya.; Uklonskaya, L. I.; Arzamestsev, E. V. (Scientific Research Inst. of Medical Radiology, Moscow). Med. Radiol.; No. 11, 66-68(1974). (In Russian).

Research conducted earlier indicated the protective effect of the antiproteolytic and antiquinine-forming compounds, β-trasylol and Σ-aminocaproic acid, on the occurrence and development of disturbances of vessel permeability in local β irradiation of the skin of rabbits. Considering the expressed radioprotective properties of dimethylsulfoxide (DMSO) in general irradiation it was deemed worthwhile to examine the combined effect of trasylol, DMSO, and aminocaproic acid. Various means of administration were employed: subcutaneous, local, etc. All three compounds were found to inhibit the development of skin lesions during irradiation. Trasylol, aminocaproic acid, and DMSO reduce skin lesions after x-ray irradiation in doses of 15,000 and 20,000 rads. DMSO is the most effective. (JPRS)

11746 INFLUENCE OF ULTRAVIOLET AND ROENTGEN RAYS ON THE STABILITY OF THE FLUID FRACTION OF HORSE FAT SUBJECT TO ACCELERATED AGEING. Olszewski, Z.; Roge, A.; Kosmala, M. (Academy of Medicine, Wroclaw). Farm. Pol.; 29: 243-249(1973). (In Polish).

The influence of Swift's test on a liquid fraction of horse fat previously subjected to the reaction of ultraviolet rays or Roentgen rays in adequate conditions was investigated. It has been found among others that Roentgen rays influence considerably the reduction of induction period of liquid fraction in horse fat. (auth)

11747 HELPER EFFECT OF NORMAL AND IRRADIATED THYMUS CELLS ON TRANSFERRED IMMUNOGLOBULIN PRODUCTION. Warner, N. L. (Walter and Eliza Hall Inst. of Medical Research, Parkville, Australia); Anderson, R. E. Nature (London).; 254: No. 5501, 604-606(17 Apr 1975).

Cellular transfer of immunoglobulin production in mice by various lymphoid cell preparations was demonstrated using allotype congenic strains, and this transfer was made use of in studies on the radiosensitivity of the B spleen cell series. In analyzing the results of the transfer it became evident that the possible role of T spleen cells in either augmenting or suppressing the transfer by B cells must be determined, and evidence is presented that T cell involvement can be demonstrated to varying degrees. All cell transfers were made intravenously to mice that had received 400 R whole-body irradiation within the previous 24 hours. (UK)

11748 THREE-DIMENSIONAL RECONSTRUCTION OF ROENTGEN ATTENUATION WITHIN WORKING CANINE HEART AND LUNGS. Greenleaf, J. F.; Robb, R. A.; Ritman, E. L.; Johnson, S. A.; Chevalier, P. A.; Wood, E. H. (Mayo Foundation, Rochester, MN). Trans. Am. Nucl. Soc.; 21: 103-104(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11749 EFFECT OF TOTAL X-RAY IRRADIATION ON MOBILITY OF NERVOUS PROCESSES IN RATS OF YOUNG AGE. Chaichenko, G. M. (Kiev State Univ.). Fiziol. Zh., Akad. Nauk Ukr. RSR; 21: No. 3, 337-342(1975). (In Russian).

Total irradiation of young rats (at the age of 3 to 4 months) in doses of 600 to 700 R resulted in weakness and inertness of the inhibitory process, in a more difficult formation of the positive conditioned reflexes after a change in the signal value of the conditioned stimuli, in development of translimit inhibition directly after irradiation, and in appearance of pathological lability (explosiveness) of the excitatory process, i.e. unbalance of the nervous processes mobility. Dynamics of alteration of the signal value of stimuli was of three-phase character: adequacy of the conditioned-reflex responses to the former values of the conditioned stimuli; relaxation in inhibition of the former differentiation and formation of a new one; and adequacy of conditioned-reflex responses to the new value of stimuli. In the irradiated rats, these phases were longer than in the control ones and the longer, the higher was the dose of irradiation. (auth)

11750 THE EFFECT PRODUCED BY HALOTHANE ON THE IRRADIATED LIVER PARENCHYMA. Brase, A.; Emminger, E.; Bockslaff, H. (Medizinische Hochschule Hannover (F. R. Germany). Inst. fuer Klinische Radiologie; Medizinische Hochschule Hannover (F. R. Germany). Abt. fuer Experimentelle Pathologie). Strahlentherapie; 149: No. 3, 296-304(Mar 1975). (In German).

The results of animal experiments show that distinction must be made between acute and chronic tissue changes produced by irradiation of the liver. The pathologico-morphological findings obtained by irradiation of the liver combined with repeated halothane administration during short-term experiments are scanty and dosage-dependent. Long-term observation has revealed higher-dosage irradiation to be followed by minor inflammation which, if combined with regular halothane administration, pro-

gresses to produce the patho-anatomical picture of chronic hepatitis with diffuse cell damage and focal necrosis even in those groups of animals which had been exposed to low-dosage irradiation. It must be assumed that even low-dosage irradiation of the liver, which fails to produce measurable changes at the beginning, may influence the structure and function of the hepatic parenchyma. The latent radiation damage manifests itself under additional toxic irradiation of the liver, such as that caused by halothane. (auth)

11751 INVESTIGATIONS ON THE GLUTAMATE-OXALACETATE TRANSAMINASE IN IRRADIATED AND NON-IRRADIATED CHICK EMBRYOS. Wendt, E.; Just, H. (Bonn Univ. (F. R. Germany). Abt. fuer Physiologie). Strahlentherapie; 149: No. 3, 333-337(Mar 1975). (In German).

The enzymatic activity of glutamate-oxalacetate transaminase (GOT) in 16 day old chick embryos was investigated in 10 minute intervals following x-ray irradiation with 1,000 R. Initially, in the tissue homogenates of the embryos and in the blood serum a decline of enzyme activity was observed, which continued for 30 minutes after irradiation. Subsequently — during a second phase — the enzymatic action was increased far beyond the norm. On the contrary, in the tissues of the allantois no significant change of the GOT-concentration was seen following irradiation. (auth)

11752 HISTOLOGICAL STUDIES AFTER EXPERIMENTAL GRID IRRADIATION. P. 4. Findings in the Skin. Unger, E. (Orszagos Frederic Joliot-Curie Sugarbiologiai es Sugaregeszsegugyi Kutato Intezet, Budapest (Hungary)). Strahlentherapie; 149: No. 3, 305-309(Mar 1975).

In the skin of the rat, with longer focus-to-grid distance and wider slot openings, the grid pattern corresponding to the inhomogeneous dose distribution may be demonstrated by histologica means; after slot irradiation the damaged skin portion corresponding to the slot may be recognized. The shorter length of this skin portion compared with the width of the slot as well as the differences after grid irradiation of the average length of the severely damaged and relatively intact portions is in accordance with the authors conception, justified already by previous experiments, namely that the tissue parts covered by the bars of the grid exert a protective influence on the adjacent directly irradiated tissues. (auth)

11753 EFFECTS OF FEEDING AN ELEMENTAL DIET DURING ABDOMINAL IRRADIATION. Pageau, R. (Sherbrooke Univ., Quebec (Canada). Dept. of Nuclear Medicine and Radiobiology). Strahlentherapie; 149: No. 3, 318-323(Mar 1975).

Rats fed with normal laboratory feed or elemental diet 3,200-BD (Mead Johnson) were administered fractions of 240 rad (^{60}Co γ radiation) abdominally. Consumption of food and its nutritional efficiency were the parameters studied. Anorexia occurred rapidly following only one fraction of 240 rad and was unaffected by the feeding of the diet. Animals fed the latter, however, recovered normal appetite much faster upon completion of abdominal irradiation than those fed normally. While nutritional efficiency of the diet was smaller than that of normal feed with the controls, the opposite was obtained with irradiated animals. (auth)

11754 RADIATION EFFECTS ON RAT TESTES. P. 7. Alterations in Nucleic Acids and ^{32}P Incorporation After Partial Body Gamma Irradiation. Gupta, G. S.; Bawa, S. R. (Punjab Univ., Chandigarh (India). Dept. of Biophysics). Strahlentherapie; 149: No. 3, 324-332(Mar 1975).

Effects of partial body gamma irradiation have been studied on rat testis at lethal (2,000 R) and sublethal (720 R) doses. Radiation produced a progressive decline in DNA and RNA content of testis for first 15 days at both lethal and sublethal doses, followed by recovery as evidenced up to 74 days without any evidence for recovery of spermatogenesis. The incorporation of ^{32}P into nucleic acids was also low as compared to normal rats on day 8 postirradiation. Subsequently there was a tendency for the enhanced incorporation of ^{32}P in nucleic acid fractions. The ^{32}P nucleic acids specific activities were higher on 74th day in radiated rats than in normal controls. Enhanced incorporation of ^{32}P in nucleic acids and phospholipid fractions after 15 days of irradiation indicates greater synthetic activity of testicular interstitium rather than the recovery of germ cells. (auth)

11755 CRYPT AND CELL SIZE KINETICS IN IRRADIATED INTESTINAL EPITHELIUM. Kononenko, A. M.; Gagarin, A. I. (Leningrad Sanitary-Hygienic Medical Inst.). Tsitologiya; 17: No. 5, 576-579(May 1975). (In Russian).

The average value of axial cryptal section area and cell section area on it were studied during 8 days after total x-ray irradiation of male mice (400 rad). A small reducing of cryptal area (20%) during destructive period (1 to 2 days) is followed by a big overshoot (60%) during regenerative time (3 to 7 days). The cryptal sizes in regenerative period deviate from a steady state more than during destructive time. There are two high waves of abnormal growth of cell sizes above the steady level: the first one during destructive time and the second one during regeneration. This level seems to be near to minimal sizes of cryptal proliferative cells which are necessary for proliferation. It means that normal intestinal epithelium is a very economical and stabilized system. It is possible to evaluate quantitatively the associated with proliferation flow of substance per crypt cell for normal and irradiated intestine by means of index Iv where I is mitotical index and v – the cell volume. Cell hypertrophy at the time of regeneration on the 4th to 7th days and later after irradiation (130 to 160%) was revealed. The crypt cell hypertrophy is the factor of destabilization of irradiated intestinal epithelium. (auth)

11756 EFFECT OF IODODEOXYURIDINE ON TUMOR INDUCTION IN X-IRRADIATED RATS. Myers, D. K. (Chalk River Nuclear Labs., Ont.). Experientia; 31: No. 6, 687-688 (15 Jun 1975).

The combined effects of IUdR and x radiation were studied in order to determine whether this compound would increase the carcinogenic effects of x rays in rats. The IUdR treatment alone did not appear to induce tumor development. The injection of IUdR did increase markedly the short-term lethal effects of x rays, but failed to increase the incidence of tumors elicited by x irradiation. (ERB)

11757 EFFECT OF WHOLE-BODY X IRRADIATION ON LIVER OF ALBINO RATS. Mehta, S. (S. P. Medical Coll., Bikaner, India); Mehta, L.; Mongia, S. P. Indian J. Exp. Biol.; 13: No. 1, 73-75(Jan 1975).

Study of the structural changes in the liver of albino rats following whole-body irradiation to varying doses (250 to 1000 R) has been undertaken. Different degrees of liver damage have been observed. Liver changes included, cytoplasmic vacuolation, pyknotic nuclei, widening of liver cords, perivascular infiltration, haemorrhage, and cellular necrosis followed by early fibrosis. Severity of damage was directly related to the dose of exposure, and recovery varied inversely with the size of the dose. The changes were not specific to irradiation only and may have resulted due to general toxemia. (auth)

11758 EFFECT OF THE INTRAVENTRICULARLY INJECTED 6-HYDROXYDOPAMINE ON THE IRRADIATION-INDUCED STRESS RISE OF PLASMA CORTICOSTERONE. Popov, P. G.; Ankov, V. K.; Georgiev, V. P.; Kavrakirova, S. V.; Belokonsky, I. S. (Inst. of Physiology, Sofia). Compt. Rend. Acad. Bulg. Sci.; 27: No. 12, 1743-1746(1974).

Male albino rats received two intraventricular injections of 6-hydroxydopamine (6-OHDA) or Solvent. Seven days after the second injection the rats were x-irradiated at a dose of 900 R. Three hours after irradiation, the plasma corticosterone level showed a rise typical for the irradiation stress. This rise was equally expressed in both control irradiated and 6-OHDA treated and irradiated rats. Injection of p-chlorophenylalanine, an inhibitor of tryptophan hydroxylase, before irradiation did not influence the irradiation-stress induced rise in plasma corticosterone level either. Thus, the neural mechanisms of the radiation stress remain unexplained. (ERB)

Invertebrates

11759 (STI/PUB-377) STERILITY PRINCIPLE FOR INSECT CONTROL, 1974. Proceedings Series. Proceedings of a Symposium Held in Innsbruck, 22-26 July 1974. (International Atomic Energy Agency, Vienna (Austria)). 1975. 622p. (In Several Languages). (CONF-740754-). IAEA $36.00.

Separate abstracts were prepared for the 53 papers presented at the conference. (HLW)

For abstracts of individual papers see: 11762–11814.

11760 DEVELOPMENTAL SUCCESS OF TWO SPECIES OF Ips (COLEOPTERA: SCOLYTIDAE) IN A CHRONICALLY IRRADIATED FOREST COMMUNITY. Brower, J. H. (Brookhaven National Lab., Upton, NY). Can. Entomol.; 106: No. 3, 233-238 (Mar 1974).

Pinus rigida trees exposed throughout the study to chronic gamma irradiation were inventoried to determine the intensity of attack by the bark beetles Ips grandicollis and I. calligraphus. Beetle developmental success was determined from bark samples by estimating the percentage of the cambial surface utilized. Trees killed by high radiation doses were attacked by the beetles even though radiation exposure proved lethal (>500 R/day). In dead trees receiving lower doses adults survived but progeny were killed during different stages of development, depending on the dose rate. Developmental success was less on the exposed side of each tree than on the shielded side. Species with short life cycles have a survival advantage over those that have a long life cycle when exposed to chronic irradiation. (auth)

11761 RADIORESISTANCE OF THE RED FLOUR BEETLE, TRIBOLIUM CASTANEUM (COLEOPTERA: TENEBRIONIDAE), EXPOSED TO SUBLETHAL DOSES OF GAMMA IRRADIATION FOR 25 GENERATIONS. Brower, J. H. (Agricultural Research Service, Savannah). Can. Entomol.; 106: No. 3, 241-246(Mar 1974).

Populations of Tribolium castaneum (Herbst) exposed to sublethal doses of irradiation (0.5 to 4.0 krad) each generation for as many as 25 generations had decreases in reproductive capacity and increases in sterility that were positively correlated with the size of the dose per generation, but not with the number of ancestral generations treated. Exposure of the selected populations to an acute dose of irradiation (2.0 krad) revealed no increase in tolerance to irradiation even after 25 generations of selection. Radioresistant populations would probably not arise from fertile survivors of irradiation disinfestation of bulk grain. (auth)

11762 USE OF THE STERILE-MALE TECHNIQUE IN PLANT PROTECTION PROGRAMMES. Cavin, G. E. (Dept. of Agriculture, Hyattsville, MD). pp 3-9 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

The world food crisis emphasizes the need for new approaches to pest control, such as offered by the sterile-male technique. Various plant protection programmes in which the sterile-male technique is being used or is proposed are discussed, and other possibilities for its use are suggested. (auth)

11763 STERILE-MALE TECHNIQUE FOR CONTROL OF THE MEDITERRANEAN FRUIT FLY, CERATITIS CAPITATA WIED., IN THE MEDITERRANEAN BASIN. Serghiou, C. (Ministry of Agriculture and Natural Resources, Nicosia, Cyprus). pp 11-28 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

Certain problems caused by the use of insecticides in the management of agricultural pests, such as environmental pollution, insecticide resistance and disturbance of biological balance, has led to the development of selective pest control methods. A prominent place among these for the control of the Mediterranean fruit fly has been attained by the species specific sterile-insect technique (SIT). This study reviews the status of field programmes in countries of the Mediterranean basin, and of related mass rearing, irradiation and field release methodology. The SIT has been successfully tested in Spain, Italy, Israel and Cyprus. In all these cases, however, tests were conducted in small semi-isolated areas where at best a high degree of suppression but not eradication of the fly could be obtained since immigration of gravid females was always possible. The SIT programme in Cyprus and data on medfly ecology in the island is here reviewed in more detail. A proposal is made for the eradication of medfly from Cyprus by the use of an integration of methods, namely bait spraying, cultural practices and sterile-insect releases. (auth)

11764 USE OF TRAPS AND FRUIT INFESTATION IN THE EVALUATION OF MEDFLY FIELD POPULATIONS. Simon F., J. E. (Estacion Experimental Agraria, La Molina, Lima); Velarde R., O.; Zavala P., J. pp 29-48 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

The medfly, Ceratitis capitata Wied., was reported in Peru for the first time in 1956. Estimates of the size of the medfly population have been made by either McPhail or Steiner traps, the data being used to estimate the efficiency of systems for controlling the pest. The results of a study in the Moquegua valley in Peru are presented, with an additional form of evaluation: percentage of damage. (auth)

11765 GENETIC CONTROL OF CERATITIS CAPITATA WIED. BY THE STERILE-MALE TECHNIQUE: ACTIVITIES CARRIED OUT IN SPAIN (1969-73). Ros, J. P. (Instituto Nacional de Investigaciones Agrarias, Madrid). pp 47-92 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency(1975). (In Spanish).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

Progress made between 1969 and the last field season in 1973 is described. The first part (A) deals with studies on the dispersion, longevity and population dynamics of sterile males released in the field. The final conclusion is that these tests are subject to so many variables (wind direction, humidity, orientation, etc.) that they are valid only for the experimental site, and the data obtained cannot be applied to other sites having different characteristics. The second part (B) studies the ecology of Ceratitis in Granada province. Studies carried out during two successive years show displacement of the pest from the coast (south), where it lives in the adult stage throughout the year, to the interior (north) as the temperatures continue to rise and fruits ripen. This aspect is being investigated in order to verify whether the displacement reflects migration of the insect or in situ wintering with ecolsion when the optimum temperatures are reached. The third part (C) gives the details of three experiments on the control of C. capitata by the sterile-male technique in Murcia (1969) and Granada (1972 and 1973). The results, as well as the progress made in the transport of refrigerated adults and methods of release in the field, were highly satisfactory. (auth)

11766 STERILIZATION OF THE MEDITERRANEAN FRUIT FLY CERATITIS CAPITATA WIED.: AN INDUSTRIAL METHOD STUDIED BY CNEN FOR PEST AUTOCIDAL CONTROL BY THE STERILE INSECT TECHNIQUE. De Murtas, I. D.; Cirio, U. (Nazionale per l'Energia Nucleare, Rome). pp 49-55 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975). (In French).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

A new method is suggested for industrial irradiation of the Mediterranean fruit fly, Ceratitis capitata Wied. The gamma irradiation pilot plant belonging to the CNEN Agricultural Laboratory, with which unlimited numbers of fruit flies can be treated, is described. The flies are irradiated at the adult stage, since research has shown that their sexual competitivity is then greater than that of insects irradiated at the pupal stage. (auth)

11767 APPLICATION OF STERILIZATION TECHNIQUES TO ANASTREPHA SUSPENSA LOEW IN FLORIDA, UNITED STATES OF AMERICA. Burditt, A. K. Jr. (Dept. of Agriculture, Miami); Lopez-D., F.; Steiner, L. F.; von Windeguth, D. L.; Baranowski, R.; Anwar, M. pp 93-101 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

Research at the USDA Subtropical Horticulture Research Station in Miami, Florida, and at the University of Florida Agricultural Research and Education Center at Homestead, Florida, demonstrated that the Caribbean fruit fly could be reared on several different rearing media containing sugar-cane bagasse-citrus pulp, rice hulls or ground corn cobs as bulking agents or on a diet based on agar. These diets were used to rear large numbers of larvae for irradiation studies and sterilization research. Irradiation studies have shown that adults as well as pupae can be sterilized with five to eight krad of gamma irradiation from a ^{60}Co source. The higher dose of irradiation caused some injury to the flies. Studies of Caribbean fruit fly populations on Key West showed that release of up to 115,000 sterile flies per square kilometre weekly would suppress the fruit fly population. Research to determine the effects of gamma irradiation on Caribbean fruit fly is continuing in Miami. Our research has demonstrated that suppression would be possible. However, since most of the host fruits for this fly are not commercially produced in Florida, there is no economic justification for suppression at this time. Procedures have been developed for mass rearing, sterilization, release and monitoring populations of the Caribbean fruit fly, and a suppression campaign could be undertaken if economically justified. (auth)

11768 RESEARCH ON THE TECHNIQUE OF RADIATION STERILIZATION OF INSECT PESTS IN THE USSR. Andreev, S. V.; Martens, B. K. pp 103-116 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975). (In Russian).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

Great importance is attached in the USSR to the radiation sterilization technique, which is considered to be an effective means of controlling insect pests. Attention is devoted especially to the study of the biological action of ionizing radiations of agricultural pests (grains, pulses, dried fruits, etc.). These studies have established the basic parameters and conditions of radiation disinfestation of foodstuffs during storage. The data obtained have been used for designing facilities for disinfestation of grains and pulses in continuous operation. Large-scale research is being conducted on the application of the radiation sterilization

technique for controlling agricultural pests. The research material used includes the turnip moth (Argotis sagetum Schiff), cotton bollworm (Chlorides obsoleta F.), cabbage fly (Chortophila brassicae L.), melon fly (Muiopardalis pardalina Big.), mallow moth (Lepidoptera, Gelechidae), apple-tree ermine moth (Hyponomenta maliness L.), peach moth (Grapholitha molesta), beet fly (Pegomyia hyoscyami Pz.), codling moth (Laspeyresia pomonella), bean weevil (Acanthoscelides obtectus Say), pea beetle (Bruchus pisorum L.) and a number of other pests. The studies have served as a basis for determining the optimum values of sterilizing doses, the most suitable sterile-fertile insect ratios and other characteristics needed for practical application of the radiation sterilization technique (insect sterilization facilities, automated facilities for large-scale rearing, nutrient media for growing insects under artificial conditions, etc.). (auth)

11769 ECONOMICS OF THE STERILITY PRINCIPLE FOR INSECT CONTROL. Some General Considerations. Bradbury, F. R.; Loasby, B. J. (Univ. of Stirling, Scotland). pp 119-133 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

A distinction is made between investment appraisal and cost-benefit analysis, the former being appropriate for private industry investment decisions and the latter for decisions by governments or public agencies. Both evaluation methods are examined and contrasted, and the significance of discounting to allow for the time of money and other resources is argued. The concepts of cost-benefit analysis are explained by means of a simple matrix, and it is concluded that if present estimates of costs and benefits are accepted, sterile-male control or eradication methods (SIRM) will have to be credited with very large positive values for reduction in pollution and toxic hazards to compensate for its much greater costs compared with conventional chemical control methods, if these are to be replaced by SIRM. The question of commercialization of SIRM is discussed, and the view advanced that industrial skills should be harnessed but, because of the nature of the SIRM technology, normal competitive market forces are inoperative and industry involvement must be through government contract. Some areas of uncertainty in the development of SIRM to full operational implementation are identified, and the ways in which industrial skills could contribute to uncertainty reduction are discussed. Finally, it is argued that the future of pest control technology is moving in the direction of greater involvement of government and regional control. This, and the likely spread of insect resistance, may give SIRM better prospects of adoption in the long term than it is believed to have in the short. (auth)

11770 SOME ECONOMIC FACTORS AFFECTING CHOICE OF THE STERILE INSECT RELEASE METHOD AS PART OF A PEST CONTROL PROGRAMME. Lever, B. G. (ICI Plant Protection Ltd., Haslemere, Eng.). pp 135-149 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

The choice of sterile insect release as a potential pest control measure depends on an analysis of its technical, economic, and organizational merits and disadvantages in relation to alternative pest control techniques and the importance of the insect attack. Generally sterile insect release is more likely to be cost effective when pest population densities are very low, and when the potential economic benefit from control is high. These types of situations could occur in integrated programmes to eradicate disease vector species or in prevention of seasonal migration of a major pest. (auth)

11771 ECONOMIC FEASIBILITY OF ESTABLISHING A PILOT PLANT FOR CONTROL OF THE MEDITERRANEAN FRUIT FLY BY DISTRIBUTION OF STERILE MALES. Spharim, Y. (Agricultural Research Organization, Bet Dagan, Israel). pp 151-158 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

Control of the Mediterranean fruit fly is today effected by the application of bait from the air. This is a cheap and effective method, which complies with the strict criteria concerning contamination with fruit fly in the countries for which Israeli exports are destined. It is now proposed to examine a new method of controlling the Mediterranean fruit fly by distributing sterile males, within the framework of a pilot plant. Up to now, experiments with the new method were made on a small scale, and results showed that fly populations could be reduced in this way, but control was not complete. Another small-scale experiment is now in preparation; if results are favourable, an experiment on a pilot plant scale would be technically feasible. A discussion is presented, in terms of economic feasibility, of (a) whether a pilot plant should be put up, and (b) the maximum size of such a test. Results of the present investigation show that if export of fruit free from pesticide residues can indeed be envisaged, then the benefit derived from establishing a pilot plant may compensate for any damage involved in a test failure. The maximum scope of a pilot plant, according to the postulates detailed here, could reach a gross of 6-9 thousand hectares. (auth)

11772 MATHEMATICAL MODELS AND COMPUTER SIMULATION OF INSECT CONTROL. Bogyo, T. P. (Washington State Univ., Pullman). pp 161-168 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

Various types of mathematical models are described and illustrated and their use is contrasted with those of computer simulation models used for analysing natural systems, in particular systems of insect control. (auth)

11773 STUDIES OF POPULATION STRUCTURE AND DYNAMICS OF THE CODLING MOTH FOR THE DEVELOPMENT OF A MODEL OF A STERILE-MALE RELEASE STRATEGY. Sluss, R. R.; Ferro, D. N.; Bogyo, T. P. (Washington State Univ., Pullman). pp 169-176 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

The population dynamics of Laspeyresia pomonella L. (the apple codling moth) from an unmanaged, isolated apple orchard and a commercial apple orchard, both located in the Yakima Valley of Washington State, have been compared and considerable differences between the two types of populations were found. In the unmanaged orchard over 90% of individuals are univoltine and only about 10% are multivoltine, whereas in the commercial orchard the situation is the opposite (10% univoltine and 90% multivoltine). Possible causes of this phenomenon are discussed. (auth)

11774 STERILIZATION AND ITS INFLUENCE ON THE QUALITY OF THE EUROPEAN CHERRY FRUIT FLY, RHAGOLETIS CERASI L. Boller, E. F.; Remund, U.; Zehnder, J. (Swiss Federal Research Station for Arboriculture, Viticulture, and Horticulture, Waedenswil). pp 179-189 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

Field releases of sterile cherry fruit flies aiming at the eradication of this important pest in specific target areas were begun in Switzerland in 1972. Experimental data on sterilization and quality control procedures are presented. Unlike other Tephritid species, Rhagoletis cerasi males are more sensitive to gamma irradiation than females when sterilized in the adult stage. Pupal diapause leads to a heterogeneous development of the pharate flies, and makes irradiation at defined developmental stages of the pupae impossible. Pupal irradiation leads therefore to increased somatic damage in the fly population and has stimulated investigations on adult irradiation. The influence of irradiation on important components of the flies' quality, such as longevity, flight characteristics, capability to locate host and sexual partner, mating activity and successful transfer of viable sperm in repeated matings has been investigated. No apparent detrimental effects on these parameters could be detected up to irradiation doses of 10 krad, the dose used in the present SIT programme in northwest Switzerland. (auth)

11775 OBSERVATIONS ON THE FLYING BEHAVIOUR OF THE EUROPEAN CHERRY FRUIT FLY (Rhagoletis cerasi L.). Haisch, A. (Bavarian State Inst. for Soil and Plant Cultivation, Munich). pp 191-199 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

An experiment has been conducted to gain information on methodological problems in releasing sterile cherry flies in order to control the population. Well-fed flies have been sterilized with gamma rays (9 kR) during the imaginal stage and released. Others, unirradiated, emerged from pupae placed in the soil. The irradiated flies showed a higher distributive movement than the non-

irradiated flies. This flying behaviour was explained by the results of laboratory experiments which indicated that the nutrition and the age of the flies influence the flight disposition. (auth)

11776 POPULATION FLUCTUATION AND DISPERSAL STUDIES OF THE FRUIT FLY, DACUS ZONATUS SAUNDERS. Qureshi, Z. A.; Ashraf, M.; Bughio, A. R.; Siddiqui, Q. H. (Atomic Energy Agricultural Research Centre, Tandojam, Sind, Pakistan). pp 201-207 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

Investigations on population fluctuation and the dispersal pattern of the fruit fly, Dacus zonatus Saunders, were carried out in two guava (Psidium guajave L.) orchards. The population fluctuation, as measured by monthly mean catches of male flies in traps baited with a mixture of methyl eugenol + naled, showed that the fly population was at its minimum in January/February and increased gradually to a maximum in March/May. The fly population declined in June/July but started building up again in August and reached a maximum in September. With the onset of winter season the fly population declined. The micro-environment seems to have played an important role in the fluctuation of fly populations. The preliminary data on the dispersal of laboratory-reared sterilized dye-marked flies indicated that most of the marked flies were recaptured from south-westerly and southern directions when the wind was predominantly west-south-west. Marked flies were recovered as far as 25 miles from the release point. (auth)

11777 PROSPECTS OF INCREASED EGG PRODUCTION IN THE REARING OF DACUS OLEAE GMELIN BY THE USE OF CHEMICAL STIMULI. Girolami, V. (Univ., Padua); Pellizzari, G.; Ragazzi, E.; Veronese, G. pp 209-217 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

An activity of stimulus to oviposition of the Dacus oleae Gmelin has been discovered in oleoeuropeine and demethyloleoeuropeine, phenolic glucosides characteristic of the olive; furthermore, the respective aglucones obtained enzymatically have also proved active, but not the ulterior, already known, products of the cleavage of the molecule. It has been possible to demonstrate that the stimulating activity is linked to products of spontaneous degradation of the glucosides and not to impurities derived from substances present in the olive, not eliminated in the course of the purification of the same. By sprinkling with the glucosides particular oviposition substrata (which are perforated by the ♀♀ without holding back the eggs, which fall and can be collected on the exterior of the network rearing cage), a significant increase in oviposition has been obtained. Research is being carried out to identify the chemical nature of the stimulating principles and also a further improvement in oviposition substrata. (auth)

11778 PROTEIN HYDROLYSATE-FREE LARVAL DIETS FOR REARING THE OLIVE FRUIT FLY, DACUS OLEAE, AND THE NUTRITIONAL ROLE OF BREWER'S YEAST. Manoukas, A. G. ("Demokritos" Nuclear Research Centre, Athens). pp 219-228 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

Artificial diets adequate for growth and development of Dacus oleae larvae were elaborated by substituting or eliminating particular constituents in routinely used diets. A larval diet containing only brewer's yeast and olive oil as nutrient sources was formulated which gave pupal yield equivalent to a soy hydrolysate-containing diet. It seems, however, that an essential factor present in soy hydrolysate (most probably free amino-acids) is required for optimum larval development time and maximum pupal weight. Increased levels of brewer's yeast in the protein hydrolysate-free diet resulted in shorter development time, higher pupal yield and heavier pupal weight. Above a minimum level of brewer's yeast larval development time and pupal weight depended upon the content of non-protein amino acids present in the yeast. It is suggested that protein hydrolysate may be omitted from the diets used at present under the condition that brewer's yeast contains a minimum level of non-protein amino acids. (auth)

11779 EFFECTS OF FRACTIONATING THE GAMMA-RAY STERILIZATION DOSE ON THE ECLOSION, FERTILITY AND COMPETITIVITY OF THE MEDITERRANEAN FRUIT FLY CERATITIS CAPITATA WIED. Mayas, I. A. (Institut de Recherches Agronomiques, Fanar, Lebanon). pp 229-236 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975). (In French).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

The effects of different ways of fractionating the sterilizing gamma-ray dose (9 krad) on older fruit fly pupae (3, 2 and 1 day before eclosion) have been studied. As a result no significant difference was observed in the adult eclosion rate and male mortality rate between batches subjected to a whole single dose and batches exposed to a fractionated dose; males from pupae subjected to fractionated irradiation show the same sterility rate as those from pupae given a single dose; competitivity between irradiated and unirradiated males tested under laboratory conditions is derived from the percentage of sterile eggs laid by unirradiated females (a ratio of 3 : 1 : 1). Males from pupae that have received the whole single dose are markedly less competitive than males that have been subjected to fractionated irradiation. The reduced competitivity persists 17 days after irradiation; and the different ways of fractionating the sterilizing dose (3, 6 and 9 fractions) did not produce results differing significantly in terms of eclosion and competitivity. (auth)

11780 PRELIMINARY EXPERIMENTS IN REDUCING THE COST OF MEDFLY LARVAL DIETS. Mourad, A. (Joint FAO/IAEA Division of Atomic Energy in Food and Agriculture, Vienna). pp 237-240 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

Brewer's or Torula yeast is used as the primary source of protein and vitamin B in artificial diets for medfly Ceratitis capitata Weid. Many countries conducting large experiments or demonstrations of medfly control by the sterile-male technique must import dried yeast for the larval diet. Shipping charges often exceed the purchase price and both require a substantial outlay in hard currency. For example, brewer's yeast in Austria costs about US $0.35/kg; shipping to the Mediterranean region costs about US $0.50/kg. The production of 100 million medfly pupae on the standard diet requires 1200 kg brewer's yeast. Because of this cost factor, alternative medfly larval media were investigated using little or no yeast. Also, molasses was evaluated as a substitute for sugar. Several satisfactory diets are reported. (auth)

11781 COMBINED EFFECTS OF RADIATION AND CHEMICAL AGENTS IN ALTERING THE FECUNDITY AND FERTILITY OF A BRACONID WASP. Grosch, D. S. (North Carolina State Univ., Raleigh). pp 243-259 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

In a search for new methods of control, we should not overlook the advantages in deranging vitellogenesis and thus strike at the basis of the prolificacy characterizing undesirable insects. Species with merioistic ovarioles are capable of rapid oogenesis because other cells generate molecules and organelles for the oocyte. Agents which interfere with such activity during vitellogenesis include metal cations, toxic elements, chelators, enzyme inhibitors, metabolite analogues, base substitution analogues and juvenile hormone analogues. In combination experiments with ionizing radiation, they prolong the radiation-induced period of infecundity and decrease the number of eggs subsequently derived from oogonia. Furthermore, hatchability of the eggs is decreased significantly. The radiation dose chosen was low enough to cause brief infecundity and thus enable detection of qualitative changes for the different cell types in the ovariole sequence. Contrasted with the enhancement of radiation effects was the duplication of effort by alkylators, the limited amelioration from mitotic inhibition, the protection by aminothiols and the subvitalization from low doses of neurotoxic pesticides. (auth)

11782 LABORATORY STUDIES ON STERILIZATION OF THE MALE RED PALM WEEVIL, RHYNCHOPHORUS FERRUGINEUS OLIV. Rahalkar, G. W.; Harwalkar, M. R.; Rananavare, H. O. (Bhabha Atomic Research Centre, Bombay). pp 261-267 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

When 1-2-day-old males of the red palm weevil (Rhynchophorus ferrungineus) were x-ray radiated with a dose of 1.5 krad, 90% sterility was induced without affecting their survival. Higher doses, however, significantly reduced male survival, although

near complete sterility was obtained. Some of the sperms present at the time of irradiation were more radioresistant and contributed towards egg viability during the initial period of oviposition. Treatment with metepa and hempa failed to induce the desired level of sterility without affecting their survival. Metepa proved more toxic than hempa. A combination of any radiation dose and hempa concentration was inadequate to induce near complete sterility without affecting male survival; an overall sterility of 87% only was obtained following exposure of irradiated males (1 krad) for 1 hour to hempa residue of 158 $\mu g/cm^2$. These males, however, exhibited to some extent improved mating competitiveness compared with those sterilized to the same level by radiation alone. (auth)

11783 EFFECT OF SUBSTERILE IRRADIATION DOSES ON THE PROGENY OF TREATED BEAN WEEVIL ADULTS (ACANTHOSCELIDES OBTECTUS SAY, COL., BRUCHIDAE). Szentesi, A. (Research Int. for Plant Protection, Budapest). pp 269-278 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

The effect of substerile doses (2, 4, 6, 8 and 10 krad) of gamma radiation applied to the parental generation of Acanthoscelides obtectus Say on the descendants' fertility and fecundity was investigated throughout four generations. The decrease in sterility of the successive generations was rather rapid, and showed differences between "closed-bred" and outbred lines. No distortion was observed in the sex ratio. Treated female parents did not transmit any sterility to their progeny. The release of substerile adults in the genetic control of the bean weevil is not recommended. (auth)

11784 INFLUENCE OF SHORT-TERM MODIFICATIONS OF THE REARING TEMPERATURE ON THE REPRODUCING CAPACITY OF THE BEAN WEEVIL (ACANTHOSCELIDES OBTECTUS SAY, COLEOPTERA, BRUCHIDAE). Biemont, J. C. (Univ., Francois-Rabelias, Tours, France). pp 279-288 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975). (In French).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

Acanthoscelides obtectus males, which are normally reared at 27°C, were kept at 36°C during the nymphal or imaginal stage for variable periods. After this thermal treatment, they were mated with females reared at 27°C. The ovarian production of the females that were mated with males kept at 36°C for 6 or 7 days during the nymphal stage, or for 10 days during the imaginal stage, was lower than that of the control females. After this treatment, the fertility was very reduced. A long thermal treatment seems to perturb the paragonia secreting activity, which produces spermatophore. The spermatophores are smaller, their structure is often altered and they have a reduced stimulating effect upon oogenesis. Moreover, a long thermal treatment perturbs the spermatozoa gathering into spermatodesms. The influence of temperature stress on females has also been studied. Half-an-hour exposure of virgin females to high temperature (45°C) at different ages causes a significant increase in egg mortality on the first day of oviposition after the treatment. Chorion-covered oocytes stored in lateral oviducts were more sensitive than young growing oocytes. (auth)

11785 METHOD OF DETERMINING THE GAMMA RADIATION DOSES FOR THE STERILIZATION OF STORED PRODUCT INSECTS. Wiendl, F. M. (Dept. of Entomology and Centre of Nuclear Energy in Agriculture, Piracicaba, Brazil); Pacheco, J. M.; Walder, J. M. M.; Sgrillo, R. B.; Domarco, R. E. pp 289-315 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

The method consists of the irradiation of infested stored grains or other products with increasing doses of gamma irradiation. The samples were weighed weekly to determine loss caused by insect attack. This loss in weight, which shows that sterilization has not occurred, can be easily detected after six to seven cycles. Differences were found in the sensitivity of insects to different environments, i.e., temperature, humidity and substrate. On maize (Zea mays L.) the Sitophilus zeamais Mots. was sterilized with 8 krad at 30°C (62 to 82% r.h.). The same insect, at 25°C (65 to 95% r.h.) was sterilized with 7 krad, and at a temperature varying between 22° and 35°C (20 to 90% r.h.), the required dose was 7 krad also. In the case of Zabrotes subfasciatus (Boh.) on beans (Phaseolus vulgaris L.), the sterilizing dose was found to be 10 krad, at a temperature of 27°C (62 to 78% r.h.). Also, on beans (Vigna sinensis Endl.) the species Callosobruchus maculatus (Fab.) was sterilized with 8 krad at 30°C (70 to 75% r.h.). The species Sitophilus oryzae (L.), reared at 27°C (62 to 78% r.h.) in various substrates had varying sensitivity to radiation. On maize (Zea mays L.) and rice (Oryza sativa L.) the sterilizing dose for this insect was 7 krad, and on macaroni 5 krad. (auth)

11786 MATING COMPETITIVENESS OF THE RADIOSTERILIZED MALE ARMYWORM, SPODOPTERA EXIGUA HB., AND THE MALE MOSQUITO, AEDES AEGYPTI L., IN FIELD CAGES. Loaharanu, S.; Chiravatanapong, S.; Sutantawong, M.; Kaochnong, P. (Office of Atomic Energy for Peace, Bangkhen, Bangkok, Thailand). pp 317-323 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

Artificially reared male armyworms, Spodoptera exigua, were exposed to gamma rays at the late pupal stage, and subsequently caged with untreated females at 1 : 1 ratio. It appeared that in the colony which contained males subjected to 30, 40 and 50 krad of gamma rays, the viability of eggs deposited was reduced to 46.31, 9.16 and 3.54% respectively, compared with 91.95% of egg-hatch in the untreated colony. Further studies were undertaken by introducing males irradiated at the doses mentioned into field cages containing untreated males and untreated females at 10 : 1 : 1 ratio. From evaluating the viability of eggs deposited, it could be reported that males that had been exposed to 50 krad of gamma rays were least competitive. Male mosquitoes, Aedes aegypti, were irradiated in the early adult stage and then mated with untreated females. It was found that males exposed to very low radiation doses could greatly reduce the viability of eggs deposited. Those exposed to 12 krad led to complete infertility in eggs. Mating and cytological studies showed that males sterilized with 12 krad of gamma rays could mate effectively. (auth)

11787 SPERMATOGENESIS AND OOGENESIS OF CERATITIS CAPITATA WIEDEMANN, DACUS DORSALIS HENDEL AND DACUS CUCURBITAE COQUILLETT WHEN SEXUALLY STERILIZED WITH TEPA AFTER ADULT EMERGENCE. Navvab Gojrati, H. A. (Pahlavi Univ., Shiraz, Iran); Keiser, I. pp 325-328 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

Three species of fruit flies were exposed to varying doses of tepa in drinking water immediately following emergence, and also in the middle of their life span, for 48 hours. Histological preparations were made of the ovaries and testes at daily intervals thereafter. It was noticeable that sperm production ceased in the anterior end of the testes, with a general necrosis of the germinal epithelium in this area. Ovaries were considerably reduced in size, very small Feulgen-positive clumps of chromatin being noted, indicating a complete breakdown of the nurse cells, oocytes and follicle cells in the ovaries. Egg laying was completely suppressed when flies were egged about 20 days after exposure to the chemosterilant. (auth)

11788 EFFECT OF INSECT CHEMOSTERILANTS ON THE DEVELOPMENT OF THE RED COTTON BUG, DYSDERCUS KOENIGII F. Harwalkar, M. R.; Rahalkar, G. W. (Bhabha Atomic Research Centre, Bombay). pp 329-336 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

Studies were carried out to examine the influence of metepa, apholate and hempa on moulting and metamorphosis in the red cotton bug Dysdercus koenigii F. Following exposure for 1 hour to a metepa residue of 43 $\mu g/cm^2$, moulting and metamorphosis of the 4th and 5th instar nymphs treated within 8-10 hours of moulting was completely inhibited. However, when the same treatment was administered during the terminal period, the 5th instar nymphs metamorphosed into adults and 4th instar nymphs moulted into 5th instar but failed to metamorphose. The inhibitory effect could be reversed to a certain extent by withholding normal food. It was observed that inhibition of moulting or metamorphosis was not caused by the failure of moulting hormone production. Topical application of apholate to early 5th instar nymphs produced effects similar to metepa but the same was not seen with hempa. (auth)

11789 APPLICATIONS OF A JUVENILE HORMONE ANALOGUE AS A STERILANT ON DYSDERCUS CARDINALIS GERST., DYSDERCUS FASCIATUS SIGN., DYSDERCUS NIGROFASCIATUS

STAL AND DYSDERCUS SUPERSTITIOSUS F. Rens, G. R. (National Agricultural Labs., Nairobi, Kenya). pp 337-348 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

Laboratory and field cage tests were carried out in Kenya to evaluate the potential of ethyl farnesoate dihydrochloride, a juvenile hormone analogue with specific action on Pyrrhocoridae, as a sterilant of four species of Dysdercus, which are important pests of cotton and other Malvaceous crops. The juvenile hormone analogue was applied by topical application on young Dysdercus males. A dosage of 100 μg technical material was required for 100% male sterility. No significant differences in susceptibility were found between Dysdercus cardinalis Gerst., D. nigrofasciatus Stal and D. supertitiosus F., but D. fasciatus Sign. was slightly more susceptible than the three other species. In further tests only D. cardinalis was used. The sterility effects were permanent at a dosage rate of 125 μg or more. By copulation with treated Dysdercus males, sterility could be passed on to untreated mating partners, but the induced infertility was not permanently 100% effective, unless high dosages were used with negative effects on the longevity and mating vigour of the treated insects. Release of sterilized males in field cage colonies of Dysdercus cardinalis caused a considerable reduction in the multiplication rate and a subsequent suppression of the normal population growth. A 60% decline in pest population was recorded over one generation cycle in a field cage colony, which had started with a 1 : 1 ratio between sterilized and normal male insects. (auth)

11790 NEW DEVICE AND CONCEPT TO ATTRACT AND STERILIZE PEST INSECTS IN THE FIELD, PARTICULARLY APHIDS (Homoptera: Aphidina). Steffan, A. W. (Institut fuer Zoologie, Biologische Bundesanstalt fuer Landund Forstwirtschaft, Berlin). pp 349-357 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

On the basis of earlier suggestions for the application of the sterility principle to the control of aphids, an apparatus has been constructed and a new concept is presented here which should enable the eradication or at least the continuous suppression of harmful species of this pest group. The new device will use yellow colour tables to attract winged aphids of the sexupara and sexual generations in the field, and to suck them into a lockable cabin where they may be treated with chemical or radiation sterilants. As the oogenesis in the sexual females as well as the spermatogenesis in the males takes place already during their embryogenesis within the bodies of their mothers, the sterilants have to be applied in sub-sterilizing dosages to the gynoparae, andropara or sexuparae. By this means, the reproduction and migration potency of the winged pre-bisexual generation members that will be captured, sterilant-treated and afterwards released, will not be reduced. The sexual females or the males should, however, be sterilized by interrupting their oogenesis or spermatogenesis while they develop in the bodies of the pre-bisexual generation to be treated. The advantage of the proposed technique compared with the usual sterile-male method is, firstly, the avoidance of expensive and time-consuming rearing and release programmes and, secondly, the fact that each sterilant-treated individual will give rise to about half a dozen sterile sexual females or males. (auth)

11791 EFFECTS OF AN ANALOGUE OF THE JUVENILE HORMONE ON OVARIAN DEVELOPMENT AND FECUNDITY IN THE HOUSEFLY, MUSCA DOMESTICA L. Bennett-Rezabova, B.; Landa, V. (Czechoslovak Academy of Sciences, Prague). pp 359-362 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

The effects of juvenile hormone analogue (methyl ester 2, 7, 11-trimethyl 7, 11 dihydro-dichloro-2 dodecenoic acid) on ovarian development in Musca domestica L. and its fecundity were investigated. The compound was applied in doses of 10-200 μg to larvae of various instars, pupae of different ages and teneral adults. Apart from examination of mortality and development of individual stages, attention was focused on ovarian development. It has been found that the effects of this analogue are similar to those of chemosterilants, i.e., certain changes occur in the follicular epithelium of egg chambers, the changes depending on the time of treatment. Tumour-like proliferation of the follicular epithelium was found in all egg chambers only when the analogue of the juvenile hormone had been administered to the last larval instar or a newly formed pupa. The ovaries then degenerated. (auth)

11792 CONDITIONAL MUTATIONS FOR THE CONTROL OF INSECT POPULATIONS. Fitz-Earle, M.; Suzuki, D. T. (Univ. of British Columbia, Vancouver, Can.). pp 365-374 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

A genetic method for insect population control has been examined. The technique involves the replacement of a population of insects with standard chromosomes by those carrying compound autosomes, thus permitting the introduction of such controlling factors as conditional mutations. Strains of the fruit fly Drosophila melanogaster, bearing compound autosomes and temperature-sensitive (ts) lethal mutations, were competed against standards in cages over continuous generations at the permissive temperature of the ts mutant. When the compounds had successfully replaced the standards, the cages were then shifted to the restrictive temperature level of the ts lethal gene. Complete elimination of the caged populations was subsequently observed. A critical evaluation is given of conditional mutations suitable for insect control, in the light of these experiments and the environmental conditions to which released insects are likely to be subjected in the wild. (auth)

11793 PRELIMINARY RADIOBIOLOGICAL STUDIES ON HYLEMYA ANTIQUA MEIGEN AND DATA ON THREE RADIATION-INDUCED (0.5 KRAD) CHROMOSOMAL REARRANGEMENTS. Robinson, A. S. (Association Euratom-Ital, Wageningen, Netherlands); van Heemert, C. pp 375-385 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

Using varying doses of x rays (500-3000 rad), seven-day-old adult male onion flies, Hylemya antiqua, were irradiated and mated to virgin females. In eggs from individual females the percentage egg hatch and the percentage of late embryonic lethals was assessed. Late embryonic lethality could be observed by the brown appearance of the eggs. The sperm of the onion fly is relatively sensitive to the radiation induction of dominant lethal mutations. Three krad gave almost complete sterility. The percentage of late embryonic lethals showed an initial rise with dose to a peak at 1 krad, thereafter there was a decline. Arguments are put forward as to the merits of using a low radiation dose for the induction of chromosomal rearrangements for insect control. To test this males were irradiated with 500 rad and the F_1-progeny were screened for reduced fertility. Out of a total of 74 test-crossed F_1-males and females three rearrangements have been isolated and confirmed cytologically to the present time, two reciprocal translocations and one pericentric inversion. The duplication/deficiency gametes from such rearrangements following fusion with normal gametes lead to late embryonic lethality, and hence produce brown eggs. However, in the two translocation stocks viable duplication/deficiency larvae (7-9 days old) have been observed. The fertility and cytology of the three rearrangements are described. Only the female carriers of the inversion showed reduced fertility. The fertility of both translocations was in excess of 50% of the wild-type value. Preliminary inbreeding has been undertaken but as yet no homozygous stock has been established. (auth)

11794 CYTOLOGICAL STUDY OF GAMMA-IRRADIATED TESTES OF THE HOUSE FLY, MUSCA DOMESTICA L. Jafri, R. H.; Dar, J. A. (Panjab Univ., Lahore). pp 387-400 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

House flies, Musca domestica L., were reared at 29° ± 2°C and 70 ± 5% r.h. Three dose levels, 2 krad, 2.5 krad and 3 krad, were used at 24 ± 6 hours before eclosion of pupae and 24 hours after emergence. The testes were examined by histological methods following hematoxylin staining, at hourly intervals for seven hours and 2, 4, 8, 10 and 12 days post irradiation. Cytological changes in all the irradiated groups showed a progressive pattern. At first, the nuclei of germ cells became pyknotic, then the vacuoles appeared in the nuclei. These lesions were followed by karyorrhexis of nuclei and degeneration of germ cells. Ultimately development of vacuoles in place of normal germ cells was thus a major phenomenon in the irradiated testes. Sperms became thick and twisty or rod-like 4-5 days after irradiation.

The sperm bundles were also seen in a broken state almost at the same time. These changes coincided with dose and time. The radiosensitivity of germ cells was deduced from cytological changes observed at different time intervals. The early and the final stages of spermatogonia, spermatocytes and spermatids were not observed at one hour following exposure to all the three dose levels, whereas they were observed in the control group. These observations show that the early and the final stages were more radiosensitive than their respective intermediate stages. Moreover, the germ cells (spermatogonia, spermatocytes, spermatids and mature sperms) followed a decreasing pattern of radiosensitivity in that order. A dose of 3 krad was found to be most effective for producing sterility, particularly when the house flies were treated with this dose at the pupal stage. This dose was sufficient to suppress all the spermatogenic activity, at least up to 12 days after irradiation. Thus, for sterility purposes, the house flies should be irradiated with 3 krad of gamma rays at the pupal stage. The house flies recovered their fertility on 10th and 12th day following 2 krad and 2.5 krad of irradiation respectively. The immediate effect of the three dose levels of gamma rays was found to be stimulatory. This was evidenced by the fact that early stages of spermiogenesis were not observed at one hour following irradiation, and instead, the late stages of spermiogenesis were observed. This stimulatory effect was also observed in the mating behaviour of the house flies. The irradiated house flies began mating two to three days after emergence, whereas flies of the control group normally began mating four to five days after emergence. (auth)

11795 INDUCED STERILITY IN IRRADIATED DIPTERA AND LEPIDOPTERA. Sperm Transfer and Dominant Lethal Mutations. LaChance, L. E. (Dept. of Agriculture, Fargo, ND). pp 401-411 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

The ability of irradiated male insects to transfer sperm and the responses these males elicit from the mated females differ in various species of insects. In the Diptera, sperm transfer, per se, plays a minor role in changing the reproductive behaviour of the female; but the transfer of secretions from the ejaculatory duct of accessory glands induces a monogamous response and stimulates oviposition. In the Lepidoptera, eupyrene sperm must be transferred and incorporated in the spermathecae to elicit changes in mating behaviour and stimulate oviposition; therefore, the ability of the irradiated and F_1 males to transfer eupyrene sperm that contain dominant lethal mutations is most important for the competitiveness of lepidopteran males. Likewise, the cytogenetic nature, mode of action and time of expression of dominant lethal mutations induced in dipteran and lepidopteran sperm differ in the two orders of insects. At sterilizing doses, the lethal mutations induced in dipteran sperm are expressed early in embryonic development; those induced in lepidopteran sperm cause death of the embryo at a much later stage of development. Implications of these factors as they relate to the application of the sterile-male technique are discussed. (auth)

11796 PRELIMINARY REPORT ON MATING STUDIES OF THREE VARIETIES OF CADRA (EPHESTIA) CAUTELLA WALKER. Ahmed, M. S. H.; Lamooza, S. B.; Ouda, N. A.; Alhassany, I. A. (Nuclear Research Inst., Atomic Energy Commission, Tuwaitha, Baghdad). pp 413-421 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

Three morphologically distinguishable strains (B, C and D) of Cadra (Ephestia) cautella Walker were started from moths collected in Baghdad, and have been bred for more than 15 generations. Results of some crosses between these strains revealed a kind of cytoplasmic incompatibility when males of either strain D or C were mated with females from strain B. Males of strain C caused a significant decrease in egg hatch when placed with males and females of strain B. Therefore, the phenomenon of incompatibility might be useful in suppressing certain populations of this insect. Field surveys carried out for a short period have shown that heterozygous individuals are prevalent which might suggest the existence of a kind of balanced polymorphism. However, extensive surveys are required to establish the actual situation in the Cautella populations. The availability of strains with easily distinguishable colours might be a useful tool in measuring various biological and ecological aspects of C. cautella populations. (auth)

11797 INHERITED STERILITY IN GONOCERUS ACUTEANGULATUS GOEZE (Rhynchota, Coreidae). Delrio, G. (Univ., Padua); Cavalloro, R. pp 423-436 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975). (In French).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

Researches have been made on sterility induced in Gonocerus acuteangulatus Goeze by ionizing radiations. The males are particularly radiosensitive and lose their mating ability at doses greater than 8 krad; on the other hand, the sexual behaviour of females remains unaltered. Examination of the effects of substerilizing doses for male and female lines on the following generations reveals an inherited sterility. In the F_1 generation the sterility was greater than that of the irradiated parents and was reduced in the following generations F_2 and F_3. In addition, mortality of larvae from eggs laid by substerile insects and a distortion of the sex ratio in favour of males were revealed. Since this species is particularly harmful to Corylus avellana L. and is responsible for two harmful diseases in hazel nuts, possible applications using the substerile male technique taking into account the greater competitiveness of F_1 males rather than that of directly irradiated insects are discussed. (auth)

11798 INDUCTION OF STRUCTURAL CHROMOSOME MUTATIONS IN MALES AND FEMALES OF TETRANYCHUS URTICAE KOCH (ACARINA: TETRANYCHIDAE). Feldmann, A. M. (Association Euratom-Ital, Wageningen, Netherlands). pp 437-446 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

Percentages of structural chromosome mutations in the F_1-progeny of Tetranychus urticae Koch were determined after irradiation of spermatids and prophase I oöcytes with 1.5 MeV neutrons and 250 kV x rays. X-rays were more effective than neutrons at doses between 1.0 and 2.0 krad for the induction of heritable structural chromosome mutations in spermatids. At doses lower than 0.5 krad, neutrons were as effective as x rays and at higher doses neutrons were more effective. Irradiation of prophase I oöcytes did not demonstrate differences in relative effectiveness of neutrons and X-rays at doses lower than 4 krad. At higher doses, x rays were more effective. In general, the relative effectiveness of neutrons and x rays for the induction of structural chromosome mutations is dose dependent. The association of strucutral chromosome mutations with recessive lethals in spermatids, is positively correlated with the irradiation dose. This observation is important from the point of view of the practical application of heritable structural chromosome mutations in genetic control, because the best probability to isolate a structural chromosome mutation in a viable homozygous condition, exists when the spermatids were irradiated at a low dose (0.2-0.5 krad x rays). The holokinetic nature of the chromosomes of T. urticae is substantiated by the correlation between the radiobiological properties of T. urticae with those of species with holokinetic chromosomes. (auth)

11799 POTENTIAL OF THE STERILE-MALE TECHNIQUE FOR THE CONTROL OR ERADICATION OF STABLE FLIES, STOMOXYS CALCITRANS LINNAEUS. LaBrecque, G. C.; Meifert, D. W.; Weidhaas, D. E. (Dept. of Agriculture, Gainesville, FL). pp 449-460 of Sterility Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

Stable flies, Stomoxys calcitrans Linnaeus, can be mass reared inexpensively and with relative ease; they can be sterilized with chemicals or gamma irradiation with little loss in viability, and their specific breeding sites and reproductive capacity limit density. The rates of increase indicate that it should be feasible to check population growth by introducing sterile insects at low ratios. Genetic manipulation other than dominant lethality appears a likely method of control. Studies with mathematical models of populations indicate that the fly can be controlled at a cost of US $0.01 to US $0.19 per acre by the sterile-male technique. (auth)

11800 RELEASES OF GLOSSINA TACHINOIDES WEST. Males at Two Natural Breeding Sites: Results and Prospects. Cuisance, D. (Laboratoire de Recherches Veterinaires de Farcha, N'Djamena, Chad); Itard, J. pp 461-476 of Sterility of Principle for Insect Control. Vienna; International Atomic Energy Agency (1975). (In French)

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

Sterile-male releases of Glossina tachinoides were made during the dry seasons in 1972 and 1973, at breeding sites along the Chari and Logone rivers. The high density of wild flies at the first site makes it impossible to determine the effect of the releases (7000 males sterilized with 15,000 rad). With regard to the batches irradiated to a greater or lesser extent, it can be said that the factors of rearing and travel reduce the flying ability of the insects and disrupt their natural rhythm during the first few days: their average lifetime is reduced to 4.8 d; and the "irradiation" factor reduces the maximum lifetime to 12 d—less than half the value for unirradiated males (28 d). The sterile males disperse over the same parts of the breeding ground and seek out the same ecological conditions for survival, but do so at a much slower pace. Their resting places during the day and night are the same, as is the elevation of the refuge points. The sterile males acquire feeding habits similar to those of the wild insects, though not until the sixth day after release. Releases carried out at the second site (4625 males sterilized with 10,000 rad) confirm the behavioral characteristics already discussed. Better performance (longevity) is obtained by making a number of releases at the most effectively protected spots and by reducing the radiation dose. Deterioration of the control site makes it impossible, by comparison, to measure the precise effect of the sterile males at the experimental breeding site, where the population is decreasing. That the sterile males do exert an influence is evident from the high percentage of sterility found in the females under observation. In view of the limitations observed during the first experiment, certain modifications were made in the second test in order to cut down as far as possible the phase required for adaptation of the released insects. The results suggest certain comments as to possible solutions and indications for use of the sterile-male technique as applied to G. tachinoides under natural conditions. (auth)

11801 TECHNIQUE FOR DETECTING ABORTIONS IN WILD POPULATIONS OF GLOSSINA SPECIES. Madubunyi, L. C. (Univ. of Nigeria, Nsukka). pp 477-485 of Sterility of Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

Female Glossina morsitans morsitans collected from the field in February 1973 were dissected in the laboratory. Records of ovarian configuration, number of ovulations, stage of pregnancy, mean spermathecal value, size of the intra-uterine content and egg in the follicle next in the ovulation sequence (FNOS) were kept for each fly dissected. Because of the significant curvilinear relationship between the FNOS and stage of pregnancy, the probable uterine content (stage of pregnancy) was defined within 95% fiducial limits on the basis of size of the egg in the FNOS. By comparing the size of fully developed eggs with the size of the eggs in the FNOS it was possible to determine whether or not a given female could have larviposited a viable and full-grown 3rd instar larva within the 24 h preceding its capture. By combining these considerations, it was determined that 8.72% of the 195 parous flies dissected had aborted. It was also possible to predict the stage of pregnancy and ovulation cycle at which the abortions occurred. (auth)

11802 TECHNIQUES FOR REARING GLOSSINA TACHINOIDES WESTW. Offori, E. D.; Dorner, P. A. (IAEA, Vienna). pp 487-494 of Sterility of Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

Techniques developed at the Seibersdorf Laboratory for rearing Glossina tachinoides Westw. are here described and the performance of a colony held for 12 months is discussed. Flies were held in a room 3.6 × 3.2 × 2.4 m high, maintained at 24.5° to 26°C and 72 to 75% relative humidity. They were fed six times a week on rabbits' ears. Seven-day-old males were mated with females 2 to 4 days old and females held for 108 days during which period pupa production averaged 8.5 per female. For separation of sexes at emergence and after mating, nitrogen gas was used to immobilize flies for about 2 to 3 minutes. The technique facilitated handling and had no adverse effect on flies. We estimated that our fly room would hold conveniently a maximum of 20,000 flies, made up of 15,000 producing females, 3000 young females and about 2000 males for mating to stock females. At the rate of production achieved in our laboratory, 15,000 females would yield 3000-4000 surplus males each week for use in a sterile-male release programme. (auth)

11803 EFFECT OF BACTERIA ON TSETSE FLIES FED THROUGH MEMBRANES. Bauer, B.; Wetzel, H. W. (Joint FAO/IAEA Division of Atomic Energy in Food and Agriculture, Vienna). pp 495-499 of Sterility of Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

The bacterial flora in colonies of Glossina morsitans fed through membranes and exhibiting the black abdomen symptom was investigated. Aeromonas spp., Hafnia spp., Flavobacterium spp., Micrococcus spp., Pseudomonas aeruginosa and some bacilli were isolated from the guts of these flies, whereas the flies from the rabbit stock colony were not infected. Gut contents of dead flies and isolates of the most common bacteria, P. aeruginosa and Aeromonas spp., were offered to non-infected flies. Most of these infected flies died with the "black abdomen" symptom within one week following infection. Sources of infection were investigated, and several precautionary measures against bacterial contamination were tested. (auth)

11804 INFLUENCE OF ANTIBIOTICS ON GLOSSINA MORSITANS WESTWOOD. Wetzel, H. W.; Bauer, B. (Joint FAO/IAEA Division of Atomic Energy in Food and Agriculture, Vienna). pp 501-505 of Sterility of Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

Certain bacterial infections of tsetse flies cause high mortality. Oxytetracycline was tested as an antibotic mixed with the blood fed to tsetse flies through membranes. Feeding the antibiotic to young females in this manner drastically reduced fecundity. Therefore oxytetracycline cannot be recommended for controlling bacterial infections in tsetse fly colonies. (auth)

11805 STUDIES ON THE ERADICATION OF ANOPHELES PHAROENSIS THEOBALD BY THE STERILE-MALE TECHNIQUE USING ^{60}Co. XI. Release-Recapture Experiments for Flight Range and Dispersion. Wakid, A. F. M. (Atomic Energy Dept., Cairo); Abdel-Malek, A. A.; Tantawy, A. O. pp 507-513 of Sterility of Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

Anopheles pharoensis Theobald is a mosquito vector of malaria in Egypt. Efforts to control it by using the sterile-insect technique are being made. An account is given of experiments in a field study on the dispersion, flight range and survival of the mosquito in the experimental area. Mosquitoes were labelled with ^{32}P during the larval stage and released from a release centre. Recapture of the released mosquitoes was achieved by scattering outlet window traps fixed in 10 surrounding collecting stations. A total of 65020 labelled mosquitoes were released and 103 recaptured. Of the recaptured mosquitoes 64 were females, giving a recapture rate of about 0.2%, and 0.12% of the males were recovered. The distribution of the recaptured mosquitoes from the release centre was highly irregular. The mean flight range of the adult mosquito was estimated to be 1087 m from the release centre with a maximum range of 2500 m. One female mosquito was recaptured 23 days from the beginning of the release. The oldest male mosquito caught was recaptured 22 days after the end of the release period. (auth)

11806 BIOLOGICAL ASPECTS AND BEHAVIOR OF HELIOTHIS VIRESCENS FABRICIUS ADULTS FROM IRRADIATED DIAPAUSAL PUPAE. Enkerlin S. D.; Mancilla Berganza, R. A.; Pena Andeliz, C. E. (Instituto Tecnologico y de Estudios Superiores de Monterrey, Mexico). pp 517-527 of Sterility of Principle for Insect Control. Vienna; International Atomic Energy Agency (1975). (In Spanish).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

The purpose of this work was to study the behavior of Heliothis virescens Fabricius by treating diapausal pupae 2-5 days after formation with 2.5 krad gamma rays, storing them at 18°C for a photophase of 10 h of light and 14 h of darkness and interrupting the diapause after different periods of storage: immediately and after 6 to 8, 14 to 15, 30 and 60 days. In inducing diapause, bioclimatic chambers with adjustable photoperiod and temperature were used. The diapausal pupae (2-5 days after formation) were sexed, divided into two equal parts and sent to the laboratory of the US Department of Agriculture, Animal and Plant Health Special Service, Plant Protection and Quarantine Program, in Monterrey, Nueva Leon State, Mexico, where one part was irradiated with a ^{60}Co bomb. The other part was not irradiated but used for pairing with the irradiated diapausal pupae. The

pupae were placed in an environment of 26°C with 14 h of light and 10 h of darkness to break the diapause. After emergence the adults were paired as follows: Irradiated male with normal female, irradiated female with normal male, irradiated male with irradiated female and, for control purposes, normal male with normal female. The pairs were placed in cylindrical plastic cages 18.5 cm in height and 7.5 cm in diameter, two pairs (two males with two females) per cage. The cages were provided with two oviposition areas—a cloth cover in the upper part and a paper filter in the lower part. A 25% water-honey solution was used as adult feed. The pairings yielded data on the fertility of eggs, transference and/or reception of spermatophores and adult longevity for both generations P_1 and F_1. The data are discussed in the paper. The most important result was that the dose of 2.5 krad led to sub-sterility, younger pupae being the most susceptible. The time of storage did not have a marked influence on the parameters studied. The sterility was transmitted with varying intensity to generation F_1. (auth)

11807 INFLUENCE OF PUPAL AGE ON THE RESPONSE OF THE ALMOND MOTH, CADRA CAUTELLA WALKER, TO DIFFERENT DOSAGES OF GAMMA IRRADIATION. Amoako-Atta, B.; Partida, G. J. (Kansas State Univ., Manhattan). pp 529-536 of Sterility of Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

When 2, 4, 6 and 8 days old, almond moth pupae were irradiated at dosages of 0, 10, 20 and 30 krad, irradiated 2-day-old pupae were the most susceptible (no adults emerged) followed by 4-day-old pupae. Mean percentage adult emergence from pupae 6 and 8 days old exposed to 10 or 20 krad was not affected; exposure to 30 krads significantly reduced emergence from 6-day-old pupae. Increasing the dosage from 20 to 30 krads increased the number of deformed adults emerging from 6-day-old pupae, but did not affect adults emerging from pupae irradiated when 8 days old. The effects on fecundity of ovipositing females indicated interaction of age, dose and sex. Irradiated females mated with normal males laid fewer eggs than normal females mated with males irradiated at the same dosage. Fecundity of adults emerging from pupae irradiated when 6 days old was more significantly reduced than was that of adults emerging from irradiated 8-day-old pupae. Developing pupae were more susceptible to radiation during earlier pupal ages, with a pronounced reduction in susceptibility between 4 and 6 days of age. Results indicated that effects on adults emerging from pupae irradiated with 20 krads when 6 days old and on those emerging from pupae exposed to 30 krads when 8 days old were not significantly different. (auth)

11808 HABITAT AS A FACTOR INDUCING DIVERSITY OF POPULATIONS IN THE CODLING MOTH AND OTHER ORCHARD PESTS, AND ITS RELEVANCE TO GENETIC CONTROL METHODS. Nagy, B.; Jermy, T. (Research Inst. for Plant Protection, Budapest). pp 537-542 of Sterility of Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

Differences in behavioral and physiological characteristics of codling moth strains strongly indicate the genetic plasticity of the species. It is supposed that habitats differing substantially in environmental factors that are relevant to the codling moth and some other orchard pests would induce development of populations showing quite different behavioral and physiological characteristics. Having taken into consideration the basic differences in determining codling moth habitats in Hungary, it is suggested that the following types occur: the farm ecotype of the commercial orchards, the semi-wild ecotype of garden districts, and the wild ecotype living on wild apple trees in woodland. Since laboratory rearing produces well-known alterations in the characteristics of the codling moth, such populations are regarded as the domesticated ecotype. These variations in the codling moth strains make the comparison of results obtained in various geographical regions very difficult, and necessitate that these factors must be taken into account in sterile-insect release experiments. With the usual chemical control of the codling moth, Laspeyresia pomonella L., and other orchard pests, it was not necessary to investigate the question whether there are significant differences between populations of the same insect species living in different habitats. However, with the development of sterile-insect release (SIRM) techniques and other biological control methods using living control agents, the importance of this type of investigation becomes clear. (auth)

11809 SOME INVESTIGATIONS ON THE ECOLOGY OF THE CODLING MOTH, LASPEYRESIA POMONELLA L., IN AUSTRIA. I. Generation Dynamics; Use of Pheromones, Light Traps and Corrugated Cardboard Rings. Fischer-Colbrie, P.; Russ, K.; Rupf, O. (Bundesanstalt fuer Pflanzenschutz, Vienna). pp 543-556 of Sterility of Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

Before practical tests for the application of the genetic control against codling moth can be initiated, it is necessary to obtain a general view of the yearly changes of the generations of the moth. Investigations on the generation dynamics of codling moth have been carried out since 1970 in various climatic regions and at various altitudes in Austria. Procedures used to evaluate a possible second generation are reviewed. (auth)

11810 INFLUENCE OF PARASITES AND PATHOGENES ON THE HIBERNATING POPULATION OF CODLING MOTH (LASPEYRESIA POMONELLA L.) IN AUSTRIA. Russ, K.; Rupf, O. (Bundesanstalt fuer Pflanzenschutz, Vienna). pp 557-563 of Sterility of Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

During investigations covering a period of three years, 1970 to 1972, parasites belonging to the following families were identified: Ichneumonidae, Braconidae, Tachinae, and Perilampidae. The following fungi were also identified: Beauveria bassiana, Paecilomyces farinosus, Verticillium lecanii, Hirsutella sp., and Tilachlidium sp. The occurrence of different species at various altitudes and habitats was studied and the fluctuation of the population density of the separate species as well as total parasitism were investigated. (HLW)

11811 SURVEY OF SYNTHETIC DIETS FOR CODLING MOTHS. Butt, B. (IAEA, Vienna). pp 565-578 of Sterility of Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

Codling moth larval diets used at present can be classified as: wheat germ-sawdust; wheat germ-agar; soya-starch; bean; and calcium alginate gel. Pupae per kilogram of diet range from 76 to 600 and the range of ingredient costs is US $1.06 to 25.00 and for labor US $52 to 112.57 per 1000 pupae. Pupal weight ranges from 16 to 52.2 mg for females and 16 to 39.9 mg for males. Larval development time ranges from 10 to 25 days and rearing temperatures from 24° to 28°C. A survey of sources and costs of ingredients is included as well as a list of publications on codling moth rearing. (auth)

11812 LARVAL DIETS FOR THE CODLING MOTH (LASPEYRESIA POMONELLA L., LEPIDOPTERA: OLETHREUTIDAE). Hatmosoewarno, S.; Butt, B. (IAEA, Vienna). pp 579-584 of Sterility of Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

Three diets for rearing codling moth (Laspeyresia pomonella L.) larvae were compared. Basically these diets were casein wheat-germ, bean and modified bean diets. Larvae were bred individually in small test tubes. Three successive generations were reared. Parameters used to measure success were larval survival, duration of larval stage, pupae obtained, adult emergence and egg production per female. Judging by the results and assuming data from individual rearing can be applied to large-scale rearing, all the diets would be satisfactory. (auth)

11813 GAMMA-INDUCED STERILITY OF THE GREATER WAX MOTH, GALLERIA MELLONELLA L., PYRALIDAE, LEPIDOPTERA. Walker, D. W.; Singh, H.; MacKay, K. P. (Univ. of Puerto Rico, Mayaguez). pp 585-592 of Sterility of Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

Adults were sterilized at 22 krad or less with cobalt gamma radiation. Males did not recover from sterilizing doses. Fractionated doses were more effective for female adults, sterilizing them at 6.6 krads, compared with 13.2 krads for a single dose. Fractionated and single doses were equally effective for male adults. Because the wax moth is a common pest of bees throughout the world its life history, habits and behavior are well-known. It makes a good laboratory test animal since it is easily reared,

it has a high reproductive rate, a short larval period, a rather long adult life span, and the sexes are easily distinguished in pupal and adult stages. The objects of this study were to determine: the dose-range needed to sterilize male adults; whether sterile males recovered virility; and whether fractionated doses are more effective than a single dose. (auth)

11814 SYNTHETIC SEX-PHEROMONE OF SPODOPTERA LITTORALIS BOISD. AND ITS USES. A Field Evaluation. Campion, D. G.; (Overseas Development Administration, London); Bettany, B. W.; Nesbitt, B. F.; Beevor, P. S.; Lester, R.; Poppi, R. G. pp 593-609 of Sterility of Principle for Insect Control. Vienna; International Atomic Energy Agency (1975).

From proceedings on the sterility principle for insect control; Innsbruck, Austria (22 Jul 1974). See STI/PUB-377; CONF-740754-.

The four components of the synthesized female sex-pheromone of S. littoralis are tetradecan-1-yl acetate (I); cis-9-tetradecen-1-yl acetate (IIA); trans-11-tetradecen-1-yl acetate (IIB); and cis-9, trans-11-tetradecadien-1-yl acetate (III). The synthetic pheromones dissolved in hexane were dispensed in small polythene containers either singly or in combination over water-trough (WT) traps located in the potato-growing region of south-east Cyprus. Only III was found necessary to attract male moths. A dose-response relationship was established in that with increased loadings an increasing number of male moths were caught during the 20-day test periods. The persistence of attraction was also dependent on the loading of the pheromone within the polythene dispensers. At a loading of 500 μg the material was attractive for approximately 20 days and at a loading of 5000 μg attraction persisted for up to 40 days. IIA in combination with III in WT traps, or with virgin females in vane traps, markedly reduced the catch of male moths. The level of inhibition was proportional to the loading of IIA in the dispensers. The cis isomer of IIB also reduced the attractiveness of female moths in vane traps, although it was a much less effective inhibitor than IIA. No marked attraction or inhibition was shown for I or IIB, neither was any synergistic action demonstrated for these substances when in combination with III. Their function is therefore at present unknown and may be related to close range mating behavior. A comparison of the catch of male moths in seven different traps baited with III indicated that the water-trough trap was the most effective. The substitution of oil for water containing detergent had no adverse effect on catch. Water-trough traps baited with III caught more males than a similar trap baited with virgin females. Vane traps baited with virgin females caught more males than similar traps baited with synthetic pheromone. The hourly catches of males in a WT trap between 1700 to 2300 h were consistently higher and more uniform when compared with a similar trap baited with virgin females. Experiments using the confusion technique were carried out. Two hundred polythene dispensers each containing 500 μg of III were evenly distributed throughout a potato field of 2000 m^2. During the test period of 19 days virtually no males were caught in a trap baited with virgin females located in the centre of the field. This was in contrast to catches in the same field both before and after treatment and with catches in a similar trap on an untreated field nearby. In another experiment using only 100 point sources of III at twice the loading, only a slight reduction in catch compared with control catches was noted. The use of the synthetic sex-attractant for the control of S. littoralis by mass-trapping or confusion techniques and in relation to a possible sterile-insect release programme is discussed. (auth)

11815 EFFECTS OF GAMMA RADIATION AND HEMPA ON THE MIDGUT OF THE DESERT LOCUST SCHISTOCERCA GREGARIA. Qureshi, S. A.; Mohiuddin, S.; Akram, N. (PCSIR-Labs., Karachi, Pakistan). Folia Biol. (Krakow); 23: No. 1, 123-127(1975).

The radiation damage ranged from slight cell disruption 4 days after treatment with 5 kR to acute cellular damage following a dose of 50 kR although complete histolysis was not observed here. The regenerative cells of the midgut which renew the epithelium were particularly sensitive to radiation. The basement membrane was also slightly more sensitive than the musculature. The peritrophic membrane was damaged with a dose of 20 kR, while with 50 kR it was severely damaged. Some other histopathological findings at the higher dose were the vacuolation of epithelium, uneven distribution of the cytoplasm, elongation of the epithelium, fading of cell boundaries, and clumping of chromatin granules in the nuclei. With treatment of 1% solution of Hempa (hexamethyl phosphotriamide) at various concentrations (10, 20, 40, 80, 100 μg/g body wt.) of 3rd instar nymphs numerous mitotically active cells and nuclei were observed 30 days after emergence of the adult. There was apparently no histopathological damage to the epithelium and musculature. (auth)

11816 FERTILITY AND SURVIVAL OF TOBACCO BUDWORMS, HELIOTHIS VIRESCENS (LEPIDOPTERA: NOCTUIDAE), FROM GAMMA-IRRADIATED FEMALES. Proshold, F. I.; Bartell, J. A. (Agricultural Research Service, Fargo, ND). Can. Entomol.; 105: No. 3, 377-382(Mar 1973).

Female Heliothis virescens (F,) were irradiated with 7.5, 15.0, 22.5, or 30.0 krad of γ rays and crossed with untreated males. Then the survival and fertility of the F_1 insects from these crosses and the survival of the F_2 descendants were studied. The F_1 survival showed a dose-dependent reduction with increasing dose, but F_2 survival was normal. Likewise, we found near-normal fertility in progeny from irradiated females, regardless of dose. (auth)

11817 X-RAY INDUCED CHANGES IN THE LEVELS OF GLUCOSE, FRUCTOSE, AND GLYCOGEN IN PERIPLANETA AMERICANA. Shivaji, S. (Delhi Univ.). Curr. Sci. (India); 44: No. 13, 473-474(5 Jul 1975).

Adult cockroaches of both sexes were exposed to whole-body x irradiation at doses ranging from 1200 to 8400 rads. Following irradiation, glucose, fructose, and glycogen were quantitatively estimated both in the midgut and hepatic caeca. Results were reported as percentage decrease from control values (unirradiated cockroaches). Quantities of glycogen, glucose, and fructose decreased in the irradiated cockroaches in a dose-dependent manner. Decreases were greater in males than in females. Glycogen decreases were due to main chain sission, while glucose and fructose decreases were the result of conversion to their corresponding uronic acids. (ERB)

Radionuclide Effects (Internal Source)

Man

Refer also to abstracts 11840 and 11848.

11818 (ANL-75-3(Pt.2)) RADIOLOGICAL AND ENVIRONMENTAL RESEARCH DIVISION ANNUAL REPORT, JULY 1973-JUNE 1974. (Argonne National Lab., Ill. (USA)). [nd]. Contract W-31-109-Eng-38. 231p. Dep. NTIS $7.60.

Separate abstracts were prepared for the 26 sections of this report. Appendixes on exposure data for radium patients and radium-induced malignancies are included. (CH)

For abstracts of individual papers see: 11720, 11721,11819-11834, 11840-11844, 11849, 11850, and 11866.

11819 (ANL-75-3(Pt.2), pp 2-6) RECENT CASES OF MASTOID CARCINOMA IN RADIUM PATIENTS. Brues, A. M.; Littman, M. S. [nd].

In Radiological and Environmental Research Division annual report, July 1973-June 1974. (Argonne National Lab., Ill. (USA)).

Mastoid carcinomas were discovered in six radium patients since 1969. All of these patients had been under investigation in the past; four were dial painters first exposed between 1919 and 1923, and two received therapeutic injections of radium, respectively, in 1931 and 1935. (auth)

11820 (ANL-75-3(Pt.2), pp 7-14) INTERRELATIONSHIPS OF RADIATION, VIRUSES, AND THE IMMUNE RESPONSE IN RADIUM-INDUCED TUMORS. Part I. Status of Current Investigations. Lloyd, E. L.; Menon, M.; Mitchen, J. L.; Mackevicius, F. [nd].

In Radiological and Environmental Research Division annual report, July 1973-June 1974. (Argonne National Lab., Ill. (USA)).

Fresh surgical material from tumors arising in the radium population was examined for the presence of virus by use of the electron microscope. A number of radiation-related human tumors were established and maintained in cell culture in attempts to induce and detect viruses. The immunological status of patients carrying a high body burden of radium has been measured using three different techniques. Two of these, the cell mediated cytotoxicity test and the detection of circulating antibodies in the sera, deal specifically with the response to osteosarcomas; the third method, using phytohemagglutinin, provides a measure of non-specific immunity. (auth)

11821 (ANL-75-3(Pt.2), pp 15-20) INTERRELATIONSHIPS OF RADIATION, VIRUSES, AND THE IMMUNE RESPONSE IN RADIUM-INDUCED TUMORS. Part II. Attempts to Detect and Isolate Viruses. Lloyd, E. L.; Menon, M.; Mitchen, J. L.; Mackevicius, F. [nd].

In Radiological and Environmental Research Division annual report, July 1973-June 1974. (Argonne National Lab., Ill. (USA)).

Numerous attempts to detect viruses in two human osteosarcoma cell lines have yielded consistently negative results. The methods used included electronmicroscopy, sucrose density gradients with optical density measurements for DNA and RNA,

and radioactively labeled DNA and RNA precursors. By contrast, virus-like particles were detected in a human lung adenocarcinoma cell line both by electronmicroscopy and by radioactivity measurements. These virus-like particles, about 80 nm in diameter, were smaller and of different morphology from those generally associated with typical oncogenic RNA viruses (approximately 100 nm). A cell culture from a carcinoma of the mastoid from a radium patient has been maintained in culture for several months. However, it is too early to say if a cell line was developed from this culture. No viruses were observed in fresh tissue taken from this tumor. (auth)

11822 (ANL-75-3(Pt.2), pp 21-25) INTERRELATIONSHIPS OF RADIATION, VIRUSES, AND THE IMMUNE RESPONSE IN RADIUM-INDUCED TUMORS. Part III. Lymphocyte Cytotoxicity to Osteosarcoma Cells in Vitro. Menon, M.; Lloyd, E. L.; Mitchen, J. L. [nd].

In Radiological and Environmental Research Division annual report, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

Lymphocytes from patients carrying a body burden greater than 0.3 muCi ^{226}Ra were tested for specific cytotoxicity to four different osteosarcoma cell lines, as well as normal human fibroblasts. Cytotoxicity indices (defined as the ratio of the number of target cells remaining, after treatment with the patients' lymphocytes, relative to the values obtained with normal control subjects) have been calculated. With one exception, no cytotoxicity was observed. This is in agreement with the fact that no fresh osteosarcomas were diagnosed. The patient in whom cytotoxicity was observed was suffering from inflammation of the hip joint at the time of the first test. When the test was repeated 10 months later, no cytotoxicity was observed. No significant nonspecific cytotoxicity was observed using lymphocytes taken from four normal control subjects with any of the target cell lines used. (auth)

11823 (ANL-75-3(Pt.2), pp 26-36) INTERRELATIONSHIPS OF RADIATION, VIRUSES, AND THE IMMUNE RESPONSE IN RADIUM-INDUCED TUMORS. Part IV. Search for Specific Antibodies to Osteosarcomas by Indirect Immunofluorescence. Menon, M.; Lloyd, E. L. [nd].

In Radiological and Environmental Research Division annual report, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

The frequency of observing immunofluorescence positive (IF^+) sera with all the osteosarcoma cell lines tested was found to be essentially the same in normal control subjects (22 percent, $^{14}/_{65}$) as in persons carrying a high burden of radium but with no evidence of current osteosarcoma (22 percent, $^{11}/_{50}$). Only one of the radium patients and two control subjects had sera which was IF^+ with two of the osteosarcoma cell lines tested. No increased frequency was observed either for the control subjects or for the radium patients when three additional tumor cell lines unrelated to osteosarcoma were examined. The sera of none of the radium patients tested could be shown to have a different pattern from those of the normal controls. In contrast, sera from lung tumor patients showed IF^+ reactions with 63 percent of all of the tumor cell lines, compared with 20 percent for the controls. With three of the cell lines the sera from the lung tumor cases showed 100 percent reactivity compared with 29 percent for the controls. These results suggest that additional antibodies must be present in the sera of these tumor-bearing patients compared with those of the controls. Although the nature of these antibodies has not been determined, it is likely that some, at least, are antibodies to fetal antigens which have been shown by others to be present in patients with other malignant tumors as well as with some nonmalignant states. If sera from patients with a high body burden of radium were shown to have a greatly increased reactivity with the cell lines studied here, malignancy might be suspected, although the possibility of other causes could not be excluded. (auth)

11824 (ANL-75-3(Pt.2), pp 37-42) INTERRELATIONSHIPS OF RADIATION, VIRUSES, AND THE IMMUNE RESPONSE IN RADIUM-INDUCED TUMORS. Part V. General Immunocompetence of Patients. Lloyd, E. L.; Mitchen, J. M.; Menon, M.; Mitchen, J. L. [nd].

In Radiological and Environmental Research Division annual report, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

Phytohaemagglutinin (PHA) has been used to measure the nonspecific stimulation of lymphocytes of radium patients, as well as those from normal control subjects. A stimulation index was determined by two methods: using tritiated thymidine as a measure of increased DNA synthesis, and using tritiated leucine as a measure of increased protein synthesis. The index was calculated as the ratio of the radioactivity measured in lymphocytes to which PHA had been added to that in similar samples from which PHA was omitted. The stimulation indices have been shown to vary over a wide range, but no significant differences were observed between the radium patients and the controls. However, this report must be regarded as preliminary, pending further investigations. Factors affecting the variability of the results are discussed. (auth)

11825 (ANL-75-3(Pt.2), pp 43-45) CHROMOSOME ABERRATIONS IN PERIPHERAL LYMPHOCYTES OF RADIUM PATIENTS. Hoegerman, S. F.; Cummins, H. T.; Bronec, J. [nd].

In Radiological and Environmental Research Division annual report, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

Data are summarized on the frequency of chromosome aberrations in all radium patients and controls whose peripheral lymphocytes have been scored for cytogenetic damage. (auth)

11826 (ANL-75-3(Pt.2), pp 46-55) EFFECT OF AN IN VITRO HYDROCORTISONE PRETREATMENT ON THE FREQUENCY OF CHROMOSOME ABERRATIONS OBSERVED IN IRRADIATED LYMPHOCYTES. Hoegerman, S. F.; Schlenker, R. A.; Cummins, H. T.; Bronec, J. F.; Oltman, B. G. [nd].

In Radiological and Environmental Research Division annual report, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

Results are presented of preliminary studies on the effect of an in vitro hydrocortisone pretreatment on the frequency of chromosome aberrations in peripheral lymphocytes obtained from four patients with body burdens of radium, a patient who has received therapeutic irradiation, in vitro irradiated blood, and two control individuals. Results suggest that pretreating lymphocytes with hydrocortisone may have value for the biological dosimetry of radiation exposure. In addition, these studies may shed light on the kinetics of lymphocyte behavior in humans. (auth)

11827 (ANL-75-3(Pt.2), pp 56-62) ESTIMATION OF ALPHA-PARTICLE DOSE FROM ^{226}Ra TO BLOOD. Marshall, J. H.; Hoegerman, S. F. [nd].

In Radiological and Environmental Research Division annual report, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

For a man with a body burden of 1 muCi ^{226}Ra, the calculated dose to blood is 0.09 +- 0.03 rad/yr from alpha particles. One-third of this dose comes from cancellous bone, two-thirds from compact bone. The beta particle dose is less than 3 percent. (auth)

11828 (ANL-75-3(Pt.2), pp 63-70) ARRAY ANALYSIS: A NEW THREE-DIMENSIONAL METHOD FOR PRESENTING THE DATA FROM RADIONUCLIDE TOXICITY EXPERIMENTS AND COMPARING THEM WITH MODELS. Marshall, J. H.; Groer, P. G. [nd].

In Radiological and Environmental Research Division annual report, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

A new method of analysis of dose-response of patients in radionuclide toxicity combines the best features of previous analyses with the capabilities of online data handling from a graphic computer terminal. We call it Array Analysis because it casts the dose-response problem into three arrays of numbers. There is one array which gives the number of individuals alive in each band of intake activity and in each interval of time since intake, this is called the A array or Alive Array. There is a second array called the N array or Number Array that gives the number of events observed in each band of activity and each interval of time. The N array may give the number of tumors, the number of tumors of a particular type, or any other event which expresses the toxicity of the radionuclide. The third array is the P array or Probability Array and into this array are loaded the results of theoretical calculations from both metabolic and toxicity models as to the probability of observing an event in a single animal in each band of injected activity and each interval of time. The product of the P and A arrays gives the predicted number of tumors in each band of activity and each interval of time. By comparing P and A with N at the computer terminal, one can see the whole picture: times, injection levels, number of events both predicted and observed, and (with a press of a key) the statistical goodness of fit between theory and experiment. The size of the arrays can be changed at will. Since the predicted number of events is based upon the actual number of individuals at risk as a function of time, the analysis allows for all competing causes of death. (auth)

11829 (ANL-75-3(Pt.2), pp 71-72) DOSE TO ENDOSTEAL CELLS AND RELATIVE DISTRIBUTION FACTORS FOR RADIUM-224 AND PLUTONIUM-239 COMPARED TO RADIUM-226. Marshall, J. H.; Groer, P. G.; Schlenker, R. A. [nd].

In Radiological and Environmental Research Division annual report, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

By calculating the ratio of the endosteal doses for equal average doses to bone for both ^{224}Ra and ^{239}Pu relative to ^{226}Ra in man, values were determined for the relative distribution factor (RDF). This factor predicts the relative toxicity of alpha-emitting radionuclides in man relative to ^{226}Ra on the assumption that the dose to endosteal cells is the causative factor. (CH)

11830 (ANL-75-3(Pt.2), pp 113-116) ^{228}Ra AND ^{226}Ra IN BONE FROM RADIUM CASES. Lucas, H. F. Jr.; Markun, F. [nd].

In Radiological and Environmental Research Division annual report, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

Measurements of both ^{228}Ra and ^{226}Ra are often required for accurate estimates of the internal radiation dose of persons exposed to radium. Since ^{228}Ra has a half-life of 5.75 years and many persons were first exposed 40 to 50 years ago, the amount of ^{228}Ra still present in the body of many cases is too small to be determined by direct measurement of external gamma rays. For some of these cases, the activity ratio of ^{228}Ra to ^{226}Ra can be measured by radiochemical analyses of bone obtained at time of surgery or after death. Data are presented for eleven cases in which radiochemical measurements of ^{228}Ra and ^{226}Ra have been made. (CH)

11831 (ANL-75-3(Pt.2), pp 161-169) MEASUREMENTS OF ^{241}Am IN VIVO SEVEN YEARS AFTER INHALATION. Toohey, R. E.; Essling, M. A.; Rundo, J. [nd].

In Radiological and Environmental Research Division annual report, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

Whole-body scanning was carried out to investigate the retention and possible redistribution of a body burden of 1.8 mu Ci of ^{241}Am, last measured in 1967. Long-term DTPA chelation therapy seems to have reduced the amounts of radioactive material in the skeleton, but to have reduced the lung burden only slightly. (auth)

Animals

11832 (ANL-75-3(Pt.2), pp 73-81) THICKNESS OF THE DEPOSIT OF PLUTONIUM AND RADIUM AT BONE SURFACES IN THE BEAGLE. Schlenker, R. A.; Marshall, J. H. [nd].

In Radiological and Environmental Research Division annual report, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

The thickness of the deposit of ^{239}Pu at endosteal bone surface in a beagle dog, 90 days after injection of monomeric ^{239}Pu, was measured by solid-state alpha spectrometry. A preliminary measurement was also made of the thickness of the ^{226}Ra deposit at ensosteal surface of beagle bone 5 hr after injection. For ^{239}Pu the maximum thickness was found to be less than 0.2 mu m and for ^{226}Ra the maximum thickness was 6.5 mu m. If ^{239}Pu is deposited in uniform concentration to a depth of 0.2 mu m or less, then the rate of escape of alpha-particle energy from the bone surface is overestimated by 2 percent or less when the deposit is assumed to be infinitesimally thick. For ^{226}Ra, uniformly deposited to a depth of 5 mu m, the overestimate is 23 to 32 percent, depending on the assumption made about daughter product retention, when the deposit is assumed to be infinitesimally thick. (auth)

11833 (ANL-75-3(Pt.2), pp 82-89) MICROSCOPIC DISTRIBUTION AND INITIAL DEPOSITION OF ^{239}Pu IN HUMAN BONE. Schlenker, R. A.; Oltman, B. G. [nd].

In Radiological and Environmental Research Division annual report, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

The initial concentrations of ^{239}Pu on endosteal surfaces of compact and cancellous bone from a person who had received a ^{239}Pu injection were determined by quantitative autoradiography. The concentrations were higher in cancellous bone than in compact bone, and concentrations in the axial skeleton were greater than in the appendicular skeleton. The values ranged from 0.4 to 4.6 pCi/cm^2, and the average over the entire endosteal surface of the skeleton was 3.0 pCi/cm^2. The bone surface to bone volume ratio was measured in a cervical vertebra and in a lumbar vertebra and was found to be 114 cm^2/cm^3 in the former and 101 cm^2/cm^3 in the latter. The total skeletal bone mass was estimated to be 2100 g and is considerably subnormal, probably because the subject suffered from Cushing's syndrome. The initial uptake of ^{239}Pu in the marrow-free skeleton was estimated to be 26 percent of the injected amount. The data were used, in conjunction with a biological model, to predict that the ^{239}Pu/^{226}Ra RBE in man will be four times the ^{239}Pu/^{226}Ra RBE observed in the Utah beagles. (auth)

11834 (ANL-75-3(Pt.2), pp 98-104) EXAMPLES OF SKELETAL VARIABILITY OF BONE MINERAL CONTENT CAUSED BY INTERNALLY DEPOSITED RADIUM-226. VonSeggen, W.; Farnham, J.; Schlenker, R. A. [nd].

In Radiological and Environmental Research Division annual report, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

The radius of a skeleton containing 15.4 mu Ci ^{226}Ra with radiation changes visible on roentgenograms was compared with a normal radius using the bone mineral analyzer and roentgenograms. Small osteosclerotic lesions in cancellous bone were difficult to detect quantitatively but were easily revealed by the x-ray transmission profile and by a conventional roentgenogram. Single site evaluation of normality or abnormality of skeletal bone mass may be greatly affected by the presence of focal osteolytic defects which can occur at the measurement site. (auth)

11835 (ORO-3728-8) MUTAGENIC EFFECT OF RADIONUCLIDES INCORPORATED INTO DNA OF DROSOPHILA MELANOGASTER. Progress Report, May 1974–May 1975. Lee, W. R. (Louisiana State Univ., Baton Rouge (USA). Dept. of Zoology and Physiology). 1975. Contract AT(40-1)-3728. 17p. Dep. NTIS $4.00.

The mutagenic effect of ^{3}H incorporated into DNA of Drosophila melanogaster was studied in relation to age and radiation dose. The ^{3}H was incorporated into DNA in the germ line by feeding male larvae in late second instar a pulse of the radionuclide. Genetic stocks were used in a mating scheme to produce a cross that produces only male larvae for labeling with the radionuclide, and another cross was made that produces the parental females as virgins since no male progeny are products. The F_1 generation was scored for losses of the X or Y chromosome because of dominant markers, Bar-Stone and yellow-plus, on the Y-chromosome. All the F_1 and F_2 males were sterile permitting out-crossing of females to non-treated stocks for sex-linked recessive lethal tests in the F_2 and F_3. (CH)

11836 (TID-26823) RESEARCH PROPOSAL AND ANNUAL REPORT NO. 15, SEPTEMBER 1, 1974 – AUGUST 31, 1975. Part B. Technical Progress. (Florida State Univ., Tallahassee (USA). Inst. of Molecular Biophysics). 1 Jun 1975. Contract AT(40-1)-2690. 48p. Dep. NTIS $5.50.

Progress is reported on the following research projects: theoretical and experimental studies of metabolic regulation; molecular excitation and energy transfer in biological systems; biological toxicity of intracellular radioisotope decay; effects of ^{125}I and ^{67}Ga on nucleus and cytoplasm of murine leukemia cells; singlet molecular oxygen energy transfer studies; excited state consequences of hydrogen bonding; electron transfer reactions for the photolysis of water as a solar energy conversion model; enzymatic modification of RNA; macromolecular modelling of RNA; chromatin structure and function; development of ultrasensitive instrumentation for detecting double or single stranded breaks in DNA from chromosomes; and biophysics of visual processes. (HLW)

11837 INTERACTION OF IRON, COBALT, AND THORIUM WITH ZINC CONTENT OF RAT PROSTATE. Chowdhury, A. R. (Central Drug Research Inst., Lucknow, India). Indian J. Exp. Biol.; 12: No. 6, 563-564(Nov 1974).

Iron (ferrous and ferric), thorium, and cobalt ions reached the prostate after a single intratesticular administration. The level of bound zinc was twice that of the free form, and it remained unchanged under the influence of these metallic salts. (auth)

11838 GIANT CELLS IN THE TESTES OF SWISS ALBINO MICE AFTER TREATMENT WITH TRITIUM. Bhatia, A. L. (Univ. of Rajasthan, Jaipur, India). Curr. Sci. (India); 44: No. 13, 470-471(5 Jul 1975).

A single dose of tritium in the form of tritiated water (20 μCi/ml of body water) was injected intraperitoneally into different age groups of mice from 1 to 8 weeks. All animals were autopsied 72 hrs after injection. Testes were fixed and stained for observation for giant cells. Two types of giant cells were observed in the seminiferous tubules of 5 and 6 week old injected mice. The two types were hypertypic (single nucleus and large cytoplasm) and multinucleate (2 to many nuclei). (ERB)

11839 SELECTIVE DAMAGE TO ERYTHROBLASTS BY ^{55}Fe. Reincke, U.; Burlington, H.; Cronkite, E. P.; Hillman, M.; Laissue, J. (Brookhaven National Lab., Upton, NY). Blood; 45: No. 6, 801-810(Jun 1975).

The low energy and short range of ^{55}Fe Auger electrons were utilized in mice to deliver lethal intracellular radiation to iron-incorporating erythropoietic precursors with minimal radiation damage to other bone marrow cells. The ensuing intramedullary, selective erythropoietic death was demonstrated by absolute and differential bone marrow cell counts and by decreased blood uptake of ^{59}Fe. The decreased number of colony-forming units in spleen colony assay and the decreased ability of transplanted bone marrow to protect fatally irradiated mice shows that the bone marrow was partially depleted of pluripotent stem cells. These data are interpreted to indicate an increased pluripotent stem cell utilization in response to increased demand for differentiation of stem cells along the erythropoietic pathway. (auth)

Nuclide Kinetics and Toxicology

Man

Refer also to abstracts 11830 and 13696.

11840 (ANL-75-3(Pt.2), pp 121-122) COMPUTER STORAGE OF DATA OBTAINED IN THE MEASUREMENT OF RADIUM IN VIVO. Essling, M. A.; Huff, D. R.; Hamrin, D. R. [nd].

In Radiological and Environmental Research Division annual report, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

The Center for Human Radiobiology Information System is a computer-based information storage and retrieval system for data collected in the radium toxicity project. A computer file called VVRA has been created as part of CHRIS to contain the results of the measurements of radium in vivo. The following information is

entered for each subject: CHR case number, height, weight, date and location of measurement, a coded description of the measurement technique, the estimated amounts of ^{226}Ra and/or ^{228}Ra in the body, and errors of precision and of accuracy to indicate the significance of the reported amounts. The patient's name is excluded from the VVRA. (auth)

11841 (ANL-75-3(Pt.2), pp 124-135) DETERMINATION OF ^{231}Pa AND ITS DECAY PRODUCTS IN URINE. Ilcewicz, F. H.; Holtzman, R. B. [nd].

In Radiological and Environmental Research Division annual report, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

Because of the uncertainties in determining the separate members of the ^{231}Pa series in vivo by whole body counting, measurements of the rates at which they are excreted provide useful supplementary information for the estimation of doses to persons with long-term contamination by ^{231}Pa. A procedure is presented here for the sequential analysis of urine for ^{231}Pa and members of its decay chain, 22-yr ^{227}Ac, 18.7-day ^{227}Th, and 11.4-day ^{223}Ra. The urine is wet-ashed with nitric acid, and the Pa is preferentially adsorbed onto silica gel, which is then separated from the supernate; the silica is removed with HF. The Pa is electrodeposited onto a stainless steel disk by the method of Talvitie. The ^{227}Th is coprecipitated from the original wet-ashed solution with cerous fluoride, and the thorium is separated from the cerium by extraction into thenoyltrifluoroacetone (TTA) at pH 2 from a concentrated solution of $AlCl_3$. After back extraction of the Th into strong nitric acid it is electroplated as above. The ^{223}Ra is coprecipitated with $BaSO_4$ and they are filtered out. Each of the separated nuclides is determined by counting in a proportional alpha-counter or in a solid-state alpha spectrometer. ^{227}Ac, the 22-yr daughter of the ^{231}Pa, is determined by aging the aqueous supernate from the TTA extraction for several months and then analyzing for the newly grown ^{227}Th. Cross contamination between the radioelements was less than 1 percent. Yields of added tracers were about 85 to 96 percent and were constant to +-3 percent between runs. (auth)

11842 (ANL 75-3(Pt.2), pp 136-141) PLUTONIUM IN THE EXCRETA OF THREE SUBJECTS 10^4 DAYS AFTER INJECTION. Rundo, J.; Starzyk, P. M.; Sedlet, J.; Larsen, R. P.; Oldham, R. D.; Robinson, J. J. [nd].

In Radiological and Environmental Research Division annual report, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

Substantial amounts of ^{239}Pu were found in the daily urine and feces excreta of two subjects who had been injected intravenously with plutonium citrate (^{239}Pu) 10^4 days previously. The urine of a third subject injected intramuscularly with ^{238}Pu contained just measurable amounts of this nuclide. (auth)

11843 (ANL-75-3(Pt.2), pp 152-160) PROGRESS IN CALIBRATION FOR THE EXTERNAL COUNTING OF PLUTONIUM IN THE LUNGS. Toohey, R. E.; Rundo, J. [nd].

In Radiological and Environmental Research Division annual report, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

Calibration factors for the proportional counter have been obtained from a pair of phantom lungs containing 1.0 mu Ci ^{239}Pu. These factors agree well with the results of a mock Pu in vivo intercalibration experiment previously performed. Some of the more important variables affecting calibration for the detection of plutonium in the lungs by external counting are discussed. (auth)

11844 (ANL-75-3(Pt.2), pp 170-174) SOFTWARE FOR A COMPUTER-BASED MULTICHANNEL ANALYZER. Kotek, T. J. [nd].

In Radiological and Environmental Research Division annual report, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

A software package has been written for a computer-based multichannel analyzer used for analysis of data from ^{226}Ra or ^{238}Pu measurements in man. This system provides for up to four independent simultaneous experiments and data storage on 9-track magnetic tape. (auth)

11845 (ORNL-tr-2905) BASIC PATTERNS OF METABOLISM OF Th-232 AND ITS DISSOCIATION PRODUCTS IN THE BODY. Pavlovskaya, N. A. Translated by Martha Gerrard from Gig. Sanit.; No. 11, 55-58(1973). 5p. Dep. NTIS $4.00.

As a result of the analysis of published data and personal experimental research the main parameters that characterize metabolism are shown to depend on the chemical nature of radionuclides, chemical properties of compounds, and their route of entry. Resorption of the thorium family (Th^{228}, Ra^{224} and Pb^{212}) depends first of all on the value of the ionic potential of ions. Distribution of radioelements in the body is determined by the route of entry, solubility of the thorium compounds, and stability of the complex ions. Kinetics of the radionuclides elimination is determined both by the chemical nature of the elements and by solubility of the thorium compounds in water. (auth)

11846 EXCRETION OF 210-Po OXIDE FOLLOWING ACCIDENTAL INHALATION. Scott, L. M.; West, C. M. (Oak Ridge Y-12 Plant, TN). Health Phys.; 28: No. 5, 563-565(May 1975).

In the handling of an unencapsulated ^{210}Po source, the release of a small amount resulted in an internal deposit of about 0.015 μCi to an employee. Urine sampling commenced about 2 days after the exposure, and fecal sampling 2 days later. Approximately 3% of the burden was excreted in the urine with a biological half-life of 33 days. The fecal excretion followed a two-component exponential with 2.4- and 52-day biological half-lives. The initial fecal to urine ratio (F/U) of 65 dropped to 20 some 20 days post exposure. After the 20th day there was a gradual increase in the ratio. The overall F/U ratio was 29. (auth)

11847 STUDIES OF ELECTOPHORETIC BINDING OF RADIOACTIVE RARE EARTHS. Rosoff, B.; Spencer, H. (Veterans Administration Hospital, Hines, IL). Health Phys.; 28: No. 5, 611-612(May 1975).

Tracer doses of ^{140}La-NTA (nitrilotriacetic acid) and ^{46}Sc-NTA were given intravenously to mice and man and tracer doses of ^{153}Sm-NTA and ^{91}Y-NTA only to mice. Paper electrophoresis and radioassays were performed on serum samples obtained 15 min after the injection of the dose in mice and after 1 hr in man. Scandium-46 showed a peak of radioactivity in the beta globulin fraction, ^{140}La migrated with the gamma globulins. Samarium-153 migrated with all the globulins and ^{91}Y did not seem to migrate with any of the protein fractions. (auth)

11848 HOT PARTICLE HYPOTHESIS: A STATUS REPORT. Cochran, T. B. (Natural Resources Defense Council, Washington, DC). Trans. Am. Nucl. Soc.; 21: 327-328(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

Animals

Refer also to abstracts 11544 and 11839.

11849 (ANL-75-3(Pt.2), pp 105-112) QUANTITIVE PARAMETERS OF BABOON BONE. Farnham, J. E.; Sonza-Novera, J. [nd].

In Radiological and Environmental Research Division annual report, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

A series of perimeters, areas, and surface-to-volume ratios were measured on bone from an adult female baboon. A large number of measurements from four skeletal sites were reduced to tabular form. Data from human bone and baboon bone are compared. The distribution and retention of ^{241}Am in adult baboons will be studied. (auth)

11850 (ANA-75-3(Pt.2), pp 142-149) DEVELOPMENT OF A METHOD FOR THE DETERMINATION OF FALLOUT PLUTONIUM IN TISSUE. Larsen, R. P.; Oldham, R. D. [nd].

In Radiological and Environmental Research Division annual report, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

In the development of the fission track method for the determination of minute amounts of ^{239}Pu, both a practicable detection system and a satisfactory separation procedure have been established. The successful application of the method to the determination of plutonium in biological tissues depends on establishing a set of conditions that will prevent the contamination of the separated plutonium by ubiquitous uranium. (auth)

11851 ^{210}Pb STUDIES IN BEAGLES. Lloyd, R. D.; Mays, C. W.; Atherton, D. R.; Bruenger, F. W. (Univ. of Utah, Salt Lake City). Health Phys.; 28: No. 5, 575-583(May 1975).

Carrier-free ^{210}Pb was administered intravenously to 10 young adult beagles in a sodium citrate citric acid solution (pH 3.5). Retention was determined by total-body counting of the 47-keV γ ray. Total excreta collections from three dogs for the first three weeks after injection were assayed intact for their ^{210}Pb content by γ counting. About 75% of the excreted ^{210}Pb appeared in the feces. The fraction of the injected activity still in the circulating blood was 40% at 1 day, 14% at 1 week, and 3% at 1 month. By 1 hr following injection, red cells contained more than 99% of the ^{210}Pb that was in blood. One dog sacrificed 28 days after administration had about 63% of the retained ^{210}Pb in the skeleton, 20% in the liver; 8% in the blood, and 9% in other soft tissues. Assuming a skeletal mass equal to 7.5% of body weight at injection, the skeleton had the highest concentration of any tissue measured. Liver concentration was about 0.8 times that of the skeleton. Relative liver concentration was much lower in two dogs sacrificed 1100 and 1497 days after injection, 0.03 and 0.005 times that in the skeleton, which contained 97 and 99%, respectively, of the ^{210}Pb retained in the total-body at death. The effectiveness of injected ^{210}Pb for osteosarcoma production in beagles appeared to be not greatly different from that of ^{226}Ra. At long times after injection, the ^{210}Po/^{210}Pb ratio in the skeleton was close to 1.0. (auth)

11852 EFFECT OF STRONG CATION EXCHANGERS ON THE ENHANCEMENT OF ELIMINATION OF ^{137}Cs FROM RAT. Majle, T.; Gorzkowski, B. (Wojskowy Instytut Higieny i Epidemiologui, Warsaw). Health Phys.; 28: No. 5, 605-610(May 1975).

Cation exchange resins Bio-Rex 40, Amberlite IR-120, and AG 50W-X4 were applied to eliminate radiocesium from rats. Cation exchangers applied with a few hours delay after contamination were shown to be highly effective. The distribution of radioactivity in individual sections of digestive tract was estimated in the presence of cation exchangers and compared with the control group. (auth)

11853 EARLY RETENTION, EXCRETION AND DISTRIBUTION OF INJECTED EINSTEINIUM CITRATE IN BEAGLES. Lloyd, R. D.; Dockum, J. G.; Atherton, D. R.; Mays, C. W. (Univ. of Utah, Salt Lake City). Health Phys.; 28: No. 5, 585-589(May 1975).

The excretion, retention, and tissue distribution of einsteinium was studied during a period of up to about 8 weeks following the intravenous injection of ^{253}Es citrate into six young adult beagles. Although the first day's urinary excretion by two of these animals was about three and six times the average of the other four dogs, excretion of the ^{253}Cf contaminant in the injection solution by these same individuals was also much higher. The ratio of excreted Cf to excreted Es in the first day's urine averaged 0.68 for all six dogs and was 0.66 and 0.72 in the two animals which excreted an abnormally high fraction of their injected Es. Of the other transuranium elements which were studied, Es appears to most closely resemble Cf in its excretion, retention, and tissue distribution. The ^{253}Es concentration of exsanguinated tissues was about equal in skeleton and liver, the two tissues of highest concentration. Thyroid concentration was about $\frac{1}{4}$ to $\frac{1}{3}$ that of the skeleton. (auth)

11854 MODIFICATIONS OF MITOCHONDRIAL RESPIRATION PARAMETERS AND LEVEL OF SOME NUCLEOTIDES IN THE HEPATOCYTE OF RAT, AFTER IN VIVO CONTAMINATION BY ^{239}Pu. Pepin, G.; Pasquier, C.; Vallee, C.; Duprey, F.; Boudene, C. (Institut National de la Sante et de la Recherche Medicale (INSERM), Paris-11 Univ., 92 - Chatenay-Malabry (France); Paris-6 Univ., 75 (France). Lab. de Biologie Cellulaire et Centre de Physiologie Cellulaire; CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). C. R., Ser. D.; 280: No. 1, 141-144(6 Jan 1975). (In French).

The in vivo pass vein contamination by plutonium citrate does not alter the chain of transport nor the process of oxidative phosphorylation of hepatic mitochondria, unlike the effects of γ irradiation. In addition to a collapse of free intramitochondria nucleotides, especially of di- and triphosphates, a high decrease of mitochondria and hepatic proteins was observed. The variations of respiratory quotient thus shown can be explained by the variations of the intramitochondria ADP and ATP level. (FR)

11855 RADIOIODINE METABOLISM IN XENOPUS THYROID GLAND THROUGH LARVAL DEVELOPMENT AND METAMORPHOSIS. Nataf, B.; Regard, E.; Hourdry, J. (Institut National de la Sante et de la Recherche Medicale (INSERM), Inst. Gustave Roussy, 94 - Villejuif (France); Paris-11 Univ., 91 - Orsay (France)). C. R., Ser. D.; 280: No. 5, 657-660(3 Feb 1975). (In French).

Radioiodine uptake and metabolism study show variations in the functional state of thyroid glands of Xenopus through larval development. During metamorphic climax, the level of hormone synthesis is the highest; after metamorphosis, labeled thyroid hormones proportion decreases significantly. Normal metamorphosis sequences depend on the gland functional state changes. (FR)

11856 STABILITY IN VIVO OF PLUTONIUM (^{239}Pu) IN THE FORM OF CITRATE. Study of its elimination and Uptake by the Liver in Rats. Boudene, C.; Pepin, G. (Institut National de la Sante et de la Recherche Medicale (INSERM), Paris-11 Univ., 92 - Chatenay-Malabry (France); Paris-6 Univ., 75 (France); CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). C. R., Ser. D.; 279: No. 21, 1677-1680 (18 Nov 1974). (In French).

By the use of ^{239}Pu as citrate, the metal was obtained in a monodispersed form, confirmed by autoradiography. This technique showed a homogeneous distribution in the liver. A comparative study of urinary and fecal elimination of ^{239}Pu and ^{238}Pu revealed the predominant role of the liver in the toxic action mechanism in acute poisoning. (FR)

11857 SUB-CELLULAR LOCALIZATION OF PLUTONIUM (^{239}Pu) CITRATE IN THE RAT HEPATOCYTE. Pepin, G.; Boudene, C. (Institut National de la Sante et de la Recherche Medicale (INSERM), Paris-11 Univ., 92 - Chatenay-Malabry (France); Paris-6 Univ., 75 (France); CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). C. R., Ser. D.; 279: No. 26, 2071-2074(23 Dec 1974). (In French).

The separation of cell components by fractional centrifugation showed that the ^{239}Pu activity in terms of grams of protein matter, is three or four times higher in the mitochondrial and lysosomal fraction than in the other fractions. Centrifugation in saccharose concentration gradient showed that a large proportion of the ^{239}Pu is bound specifically to the mitochondrial where it can cause strong perturbations by α bombardment. (FR)

11858 DISTRIBUTION AND RETENTION OF $^{169}YbCl_3$, ^{169}Yb-EDTA, AND ^{169}Yb-DTPA INJECTED INTRAVENOUSLY IN THE RAT. Baltrukiewicz, Z.; Burakowski, T.; Pogorzelska-Lis, M. (Military Inst. of Hygiene and Epidemiology, Warsaw). Acta Physiol. Pol.; 26: No. 2, 205-212(1975).

The retention and distribution of ytterbium in tissues and organs of the rat during 24 h following its injection were studied. Marked differences between $YbCl_3$ and ytterbium complexes with EDTA and DTPA were observed. Both complexes behaved in the organism similarly. The excretion of the complexes occurring mostly through the kidney was more rapid than that of $YbCl_3$. The $YbCl_3$ accumulated mostly in the liver and its excretion from this organ was less intensive than from the other organs and tissues. (auth)

11859 THOROTRAST UPTAKE AND TRANSIT IN EMBRYONIC GLIA, HEART FIBROBLASTS, AND NEURONS IN VITRO. Wessells, N. K.; Luduena, M. A.; Letourneau, P. C.; Wrenn, J. T.; Spooner, B. S. (Stanford Univ., CA). Tissue Antigens; 6: No. 4, 757-776(1974).

Thorotrast (colloidal ThO_2) was incorporated into coated vesicles, various agranular vesicles and sacs, and a surface-associated system of membranous channels in times as short as 1 min by single cultured glial and heart cells. Thorotrast appeared in "C"-shaped bodies and in small, dense bodies of the lysosomal series within ca. 25 min. With longer chase periods, thorotrast cleared from all cytoplasmic organelles except the lysosomal series. The technique of applying thorotrast and using varying chase periods failed to distinguish a class of membranous organelles, located close to the cell periphery, that might have served as a source of new cell surface during locomotory activity. Similarly, thorotrast (colloidal ThO_2) was incorporated into almost all classes of membrane-bounded organelles of growth cones and axons of single nerve cells in vitro in times as short as 1 min. This included elements of the smooth endoplasmic reticulum. No thorotrast entered the lysosomal granules in this short time. During various chase periods, the tracer disappeared from the initial sites of incorporation and accumulated in dense bodies of the lysosome series within growth cones and axons. "C"-shaped bodies may have been intermediate in that process. No unique sites of endocytotic activity or of a complete absence of endocytosis were observed that could be correlated with growth cone function and axonal elongation, though the presence of the tracer in agranular sacs of the smooth endoplasmic reticulum in growth cones could reflect hypothesized cycling of cell surface (Bray, 1973, Nature, London, 244, 93). (auth)

11860 ABSORPTION, EXCRETION, AND TISSUE DISTRIBUTION OF NATURAL ORGANIC AND INORGANIC ZINC-65 IN THE RAT (38731). Neathery, M. W.; Lassiter, J. W.; Miller, W. J.; Gentry, R. P. (Univ. of Georgia, Athens). Proc. Soc. Exp. Biol. Med.; 149: No. 1, 1-4(May 1975).

The absorption and tissue distribution of organic and inorganic forms of ^{65}Zn were studied in the rat following single tracer oral doses. Rats dosed with ^{65}Zn grown into young corn and rye plants (organic form) absorbed and retained more ^{65}Zn in tissues than those given ^{65}Zn mixed with tissue paper (inorganic forms). A part of the beneficial effect was evident when ^{65}Zn was mixed with forage. The relatively high absorption values indicate that both forms were readily available, and thus incorporating zinc into young forage protein is not of major practical importance. (auth)

11861 RELEASE OF ^{35}S FROM THE CUT HYPOTHALAMIC END OF THE PITUITARY STALK FOLLOWING INTRAVENOUS INFUSION OF ^{35}S-CYSTEINE IN RATS. Guzek, J. W.; Tomas, T. (Inst. of Physiology and Biochemistry, Lodz, Poland). Acta Physiol. Pol.; 25: No. 5, 445-452(1974).

The release of radioactive substances from the hypothalamic end of the cut pituitary stalk was determined following intravenous infusion of ^{35}S-cysteine in the rats dehydrated for 3 days. Intravenous injection of 5% sodium chloride, 1% of body weight, resulted in a distinct rise of radioactivity present in the fluid washing the cut infundibulum. In the same animals, the radioactivity of the hypothalamic tissue did not differ from that found in the controls (i.e., in animals simply dehydrated). The implications of these findings are discussed, as compared to the speed of axoplasmic transport in the infundibular axons. (auth)

11862 INCORPORATION OF ^{35}S IN THE HYPOPHYSIS AND SOME BRAIN STRUCTURES FOLLOWING INTRACISTERNAL ^{35}S-CYSTINE ADMINISTRATION IN HYDRATED AND DEHYDRATED RATS. Guzek, J. W.; Lesnik, H. (Inst. of Physiology and Biochemistry, Lodz, Poland). Acta Physiol. Pol.; 25: No. 5, 435-444(1974).

Sulfur-35-labelled cystine, in doses of 12.5 μCi, was injected intracisternally to hydrated and dehydrated rats. The whole radioactivity of the hypophysis, hypothalamus, mesencephalon, and frontal lobe was determined three and twenty four hours following the injection. The uptake of ^{35}S in the hypophysis as well as in the hypothalamus was higher in dehydrated than in hydrated animals, both three and twenty four hours after the injection. In hydrated animals, the isotope markage of hypothalamic tissue was similar to that of mesencephalon and frontal lobe. Basing on the obtained data, the axonal transport rate in infundibular axons has been calculated and found to be not below 48 mm/day. (auth)

11863 DISTRIBUTION OF GOLD Au 198 AFTER INTRAPERITONEAL INJECTION IN ANIMALS. Widner, L. A.; Teates, C. D. (Univ. of Virginia School of Medicine, Charlottesville). South. Med. J.; 68: No. 6, 687-693(Jun 1975).

From 67th annual scientific meeting of the Southern Medical Association; San Antonio, TX (11 Nov 1973).

The distribution of gold Au 198 after intraperitoneal administration in dogs and rats was determined by scans and tissue radioassays obtained 24 hours after injection. Relative activity and percent of injected radioisotope contained in different organs were calculated. The radioisotope was found to be heavily concentrated in mediastinal lymph nodes and liver, with liver uptake averaging 36.5 percent of the injected isotope 24 hours after injection. The use of therapeutic intracavitary radiocolloids should be reevaluated in light of possible excessive irradiation of the liver. (auth)

Plants

11864 DISTRIBUTION OF RADIOPOTASSIUM ABSORBED THROUGH THE ROOTS IN THE VARIOUS ORGANS OF SORGHO (SORGHUM DOCHNA F.). Morard, P. (Ecole Nationale Superieure Agronomique, 31 - Toulouse (France)). C. R., Ser. D.; 279: No. 26, 2025-2028(23 Dec 1974). (In French).

The distribution of radiopotassium (^{42}K) in the different organs of Sorgho after root absorption shows the mobility of potassium in young leaves. The distribution is also found to be more or less constant between the roots, the sheaths, and the leaves as a whole. (FR)

11865 RADIONUCLIDE LEVELS IN MATURE GRAIN RELATED TO RADIOSTRONTIUM CONTENT AND TIME OF DIRECT CONTAMINATION. Aarkrog, A. (Danish Atomic Energy Commission, Risoe). Health Phys.; 28: No. 5, 557-562(May 1975).

Information on the relative behavior of radioelements besides the well-known fallout nuclides ^{90}Sr and ^{137}Cs in cereal crops may be important in the assessment of monitoring programs after unintentional releases of radioactivity to the terrestrial environment, be it airborne or transferred from the aquatic milieu in contaminated irrigation water. In the present study a variety of radionuclides were administered as a fine spray to cereal crops at different stages of development. The direct contamination of cereals depends greatly on the stage of development of the plants. Certain nuclides, e.g. ^{90}Sr, ^{144}Ce, and ^{106}Ru will hardly show up in the grain, if contamination takes place at the early stages of development. Nuclides such as ^{65}Zn, ^{55}Fe, ^{137}Cs, ^{60}Co, and ^{54}Mn are, on the other hand, easily translocated to the seeds, and may therefore be present in cereal products even if crops have been contaminated several weeks before ear emergence. The radionuclide levels in grain relative to radiostrontinum follows with approximation the equation: $r = ae^{-bt}$, where r is the relative level and t is the time from ear emergence to contamination of the crops; a and b are constants which characterize the translocation of a nuclide relative to radiostrontium. In case of an environmental contamination of cereal crops by known (relative) amounts of ^{90}Sr and γ-emitting radionuclides it is possible to use the above equation to estimate the ^{90}Sr levels in the mature grain from γ-spectroscopical determination of the accompanying nuclides, thus avoiding laborious radiochemical analyses. (auth)

New Tracer Techniques

Refer also to abstracts 11142, 11144, 11725, and 11834.

11866 (ANL-75-3(Pt.2), pp 93-97) BONE MINERAL DATA REDUCTION: A NEW APPROACH. Kazadi, S. M.; Schlenker, R. A. [nd].

In Radiological and Environmental Research Division annual report, July 1973-June 1974. (Argonne National Lab., Ill. (USA)).

The computer program for analysis of bone mineral data obtained by x ray transmission scanning has been rewritten to improve the accuracy of the determination of bone edges and to prepare data cards for the patient records system. (auth)

11867 (STI/PUB-376(Vol. 1)) DYNAMIC STUDIES WITH RADIOISOTOPES IN MEDICINE, 1974. Volume I. Proceedings Series. Conference Held at Knoxville, Tennessee, July 15-19, 1974. (International Atomic Energy Agency, Vienna (Austria)). Jan 1975. 498p. (In French and English). (CONF-740708-(Vol. 1)). IAEA $27.00.

Separate abstracts were prepared for two papers. Abstracts of the additional 37 papers were prepared previously and appeared in NSA Vol. 30 as numbers 19040; 19042; 19043; 19044; 19045; 21415; 21442; 21443; 21444; 21445; 21446; 21447; 21449; 21454; 21459; 21460; 21462; 21464; 21467; 21468; 21472; 21476; 21465; 21475; 21477; 21479; 21480; 21481; 21485; 24415; 27285; 27286; 29831; 32607; 32609; and 32610. (CH)

For abstracts of individual papers see: 11874 and 11877.

11868 (STI/PUB-376(Vol. 2)) DYNAMIC STUDIES WITH RADIOISOTOPES IN MEDICINE, 1974. Volume II. Proceedings Series. Proceedings of a Symposium Held at Knoxville, Tennessee, July 15-19, 1974. (International Atomic Energy Agency, Vienna (Austria)). Mar 1975. 451p. (In French and English). (CONF-740708-(Vol. 2)). IAEA $25.00.

Separate abstracts were prepared for five papers. Abstracts prepared for the additional 23 papers appeared in NSA Vol. 30 as numbers 19041; 21448; 21450; 21451; 21452; 21453; 21455; 21456; 21457; 21458; 21461; 21463; 21466; 21470; 21471; 21473; 21478; 21482; 21483; 21485; 21487; 29830; and 32608. (CH)

For abstracts of individual papers see: 11871-11873, 11875, and 11876.

11869 TRACER TECHNIQUES (1974-1967). Slough, Eng.; Commonwealth Agricultural Bureaux (Feb 1975). 43p. Commonwealth Bureau of Soils Annotated Bibliography.

The bibliography (covering 190 titles) is arranged under the following headings: general, nitrogen studies, phosphorus studies, potassium studies, studies with other elements, organic matter studies, physico-chemical studies, soil water studies, pedological studies, studies in soil biology, soil fertility studies, studies in plant nutrition and physiology, root studies, and pesticide studies. (UK)

11870 COMPARISON OF ROENTGENOLOGICAL AND NUCLEAR MEDICINE FINDINGS IN THE SO-CALLED QUIESCENT KIDNEY. Luschnitz, E.; Raue, I.; Baumheier, H.; Beyer, W. (Karl-Marx-Univ., Leipzig). Z. Gesam. Inn. Med. Ihre Grenzgeb.; 29: No. 11, 448-451(1974). (In German).

A correlation study on the so-called quiescent kidney in 68 patients with etiologically different renal diseases shows that one should better speak of a functionless kidney, to which is added an ascertaining method. The notion roentgenologically functionless kidney is not identical with that of an isotopenephrographically functionless kidney is not identical with that of an isotopenephrographically functionless kidney, for in our cases 44.4 per cent of the kidneys, which were no more able to an excretion of the contrast medium, showed in the isotope nephrogram, indeed, a disturbed function. On the other hand in the isotope nephrogram one finds kidneys with very much decreased function or which are apparently functionless in prompt elimination of the contrast medium in the infusion or intravenous urogram with transient interruption or very intensive disturbance of the tubular secretion of a kidney in acute inflammatory attacks. When there is no possibility to subtract the extraparenchymal activity false interpretations of the curves of the conventional isotope nephrogram are possible. Therefore, if computers are at disposal, this new method should be used. (auth)

11871 VENOUS HAEMODYNAMICS. Friedman, B. H.; Siegel, M. E.; Rhodes, B. A.; Wagner, H. N. Jr. (Johns Hopkins Medical Inst., Baltimore). pp 105-113 of Dynamic Studies With Radioisotopes in Medicine, 1974. Vol. II. Vienna; International Atomic Energy Agency (1975).

From symposium on dynamic studies with radioisotopes in clinical medicine and research; Knoxville, Tennessee, USA (15 Jul 1974). See STI/PUB-376(Vol. 2); CONF-740708-(Vol. 2).

Relative changes in venous blood volume with position were measured in a group of normal human subjects and in patients with venous disease of the lower extremities. The method of measuring was modified and new maneuvers added in order to adapt the method for routine clinical use and possibly increase the sensitivity and specificity of the procedure. At present the study is performed by tilting the patient on an electrically controlled bed after intravenous injection of ^{99m}Tc-albumin. The count-rates over both lateral calves are recorded using 2-in NaI(Tl) crystals as an inductor of relative blood volume. Normal

values and standard deviations have been calculated and found to disclose no statistically significant differences from previously reported values. The effect of anti-embolic stockings and a new tilt maneuver on eight normal volunteers is described. Clinical examples of results in a normal volunteer, in a patient with obstruction, and in a patient with valvular incompetence are discussed. (auth)

11872 MODEL FOR THE ANALYSIS OF RADIOCARDIOGRAMS USING A DIGITAL COMPUTER IN TIME-SHARING MODE. Riihimaki, E.; Heiskanen, A.; Heiskanen, T.; Tahti, E. (Helsinki Univ.). pp 165-171 of Dynamic Studies With Radioisotopes in Medicine, 1974. Vol. II. Vienna; International Atomic Energy Agency (1975).

From symposium on dynamic studies with radioisotopes in clinical medicine and research; Knoxville, Tennessee, USA (15 Jul 1974). See STI/PUB-376(Vol.2); CONF-740708-(Vol.2).

A model is presented for the analysis of radiocardiograms. The volumes of a series of pulsating compartments were evaluated by indicator dilution technique using intravenously injected ^{113m}In as the tracer. The model is applied to the analysis of time-activity curves derived from serial images recorded with a gamma camera. The analysis is performed with a digital computer in time-sharing mode through a demand terminal. Results of normal subjects are presented. Separation of the atrial and ventricular volumes was not successful, but the blood volumes of the right and left heart agree rather well with previous findings. (auth)

11873 EVALUATION OF CENTRAL CIRCULATORY DYNAMICS WITH THE SCINTILLATION PROBE. Steele, P. P. (Univ. of Colorado Medical Center, Denver); van Dyke, D.; Ellis, J.; Trow, R.; Anger, H.; Davies, H. pp 219-227 of Dynamic Studies With Radioisotopes in Medicine, 1974. Vol. II. Vienna; International Atomic Energy Agency (1975).

From symposium on dynamic studies with radioisotopes in clinical medicine and research; Knoxville, Tennessee, USA (15 Jul 1974). See STI/PUB-376(Vol.2); CONF-740708-(Vol.2).

A radionuclide technique is presented which utilizes a scintillation probe to record left ventricular ejection fraction, blood volume, cardiac output, pulmonary transit time, and pulmonary blood volume. The probe is portable, and is applicable to studies at the bedside of the seriously ill. ^{113m}In is used which binds to transferrin and with its short half-life is ideally suited for serial studies. This technique was validated against standard measurements of central circulatory dynamics and proved accurate. In clinical studies of seriously ill patients with ventilatory failure four patterns of central circulatory dynamics were observed. These patterns, normal, left ventricular dysfunction, short pulmonary transit time and right ventricular dysfunction, have clinical correlation. In investigative studies the effects of nitroglycerin on central circulatory dynamics were quantitated and the duration of action defined. (auth)

11874 HIPPURAN NEPHROGRAMS: RESULTS EXPRESSED IN RENAL FLOW RATES AND RESIDENCE TIMES AFTER THE ANALYSIS OF DATA OBTAINED BY MEANS OF A SCINTILLATION CAMERA USING TWO ISOTOPES. Morcellet, J. L.; Baret, A. (Hopital Sainte-Anne, Toulon, France). pp 277-293 of Dynamic Studies With Radioisotopes in Medicine, 1974. Vol. I. Vienna; International Atomic Energy Agency (1975). (In French).

From symposium on dynamic studies with radioisotopes in clinical medicine and research; Knoxville, Tennessee, USA (15 Jul 1974). See STI/PUB-376(Vol.1); CONF-740708-(Vol.1).

A numerical approach is proposed for calculations of the ^{131}I-hippuran during scanning flow of fluids from each kidney (flow of purified plasma and flow of urine) and average residence times in each kidney. Use of a γ camera with two isotope channels modifies the data collection process and permits the simultaneous measurement of the systemic flow using ^{99m}Tc-albumin as tracer, which is essential for data processing. This is made possible thanks to the use of a magnetoscope which allows delayed operation and of a 100-channel analyzer which displays the numerical data and their integration. (auth)

11875 MEASUREMENT OF TRICUSPID REGURGITATION IN MAN. Laleli, Y. R. (Hacettepe Univ. Medical Center, Ankara); Oram, A.; Guener, Z. pp 285-293 of Dynamic Studies With Radioisotopes in Medicine, 1974. Vol. II. Vienna; International Atomic Energy Agency (1975).

From symposium on dynamic studies with radioisotopes in clinical medicine and research; Knoxville, Tennessee, USA (15 Jul 1974). See STI/PUB-376(Vol.2); CONF-740708-(Vol.2).

Tricuspid valve regurgitation in the heart was measured by infusing ^{113m}In or ^{133}Xe into the right ventricle at a constant rate and recording the activity of the blood that was drawn continuously from the right atrium and pulmonary artery simultaneously. A total of 51 investigations were carried out with ^{113m}In on 41 patients and 16 studies were repeated with ^{133}Xe. Results were found to be similar and to correlate with observations on 21 patients whose tricuspid valves were examined during open heart surgery. (auth)

11876 STUDY OF A REGIONAL RESPIRATORY MECHANICS USING ^{133}Xe AND A MULTIDETECTOR SYSTEM. Minh, V. (Univ. Hospital of San Diego, CA); Moser, K. M.; Overton, T. R.; Jones, R. J. Sproule, B. J. pp 379-395 of Dynamic Studies With Radioisotopes in Medicine, 1974. Vol. II. Vienna; International Atomic Energy Agency (1975).

From symposium on dynamic studies with radioisotopes in clinical medicine and research; Knoxville, Tennessee, USA (15 Jul 1974). See STI/PUB-376(Vol.2); CONF-740708-(Vol.2).

Routine assessment of overall flow measured at the mouth during the forced vital capacity (FVC) maneuver fails to detect early and localized lung disease. A method was developed using ^{133}Xe and a multidetector system to analyze regional dynamics at each zone of the lungs during the FVC maneuver. Data gathered from twenty-one normal subjects were used as a baseline for assessment of regional impairment in lung dynamics in patients. The technique consists in having the subject perform a FVC maneuver using a spirometer containing a ^{133}Xe gas mixture (1.5 to 2.0 mCi/litre). Before the FVC maneuver, the subject is instructed to rebreathe in closed circuit with the spirometer until equilibration. Regional flow indices during the FVC maneuver are derived from the decrease in regional radioactivity monitored at each of the eight lung zones by a pair of NaI detectors, one in the front collinear with one in the back. Regional flow indices were consistently higher at the bases and at the apices than at the mid-lung zones. This distribution of regional flow indices may reflect differences in regional airway resistance and the regional difference in pressure applied by the expiratory muscles during the FVC maneuver. Changing in relative geometry between chest and lung in dynamic conditions may be another factor determining the higher flow indices at the base. Further investigation is necessary for analysis of the significance of the findings. However, data as generated, being reproducible from one FVC to another in the normal group, could be used as baseline values for detection and location of localized lung disease in many conditions. (auth)

11877 ABSORPTION OF FOLIC ACID AND ITS RATE OF DISAPPEARANCE FROM THE BLOOD OF PATIENTS RECEIVING BARBITURATES IN EXCESS IN COMBINATION WITH ALCOHOL. Gyftaki, H. (Athens Univ. Medical School); Kesse-Elias, M.; Rapidis, P.; Alevizou-Terzaki, V.; Sdougou-Christakopoulou, J. pp 455-461 of Dynamic Studies With Radioisotopes in Medicine, 1974. Vol. I. Vienna; International Atomic Energy Agency (1975).

From symposium on dynamic studies with radioisotopes in clinical medicine and research; Knoxville, Tennessee, USA (15 Jul 1974). See STI/PUB-376(Vol.1); CONF-740708-(Vol.1).

It is known that megaloblastic anemia may occur from the intake of phenobarbital, which apparently responds to folic acid and vitamin B_{12}. Its site of action is not known but there is evidence that it may act as a pyrimidine antagonist. It is also known that alcoholics with or without cirrhosis have folate deficiency. Furthermore, although potentiating effects of alcohol and barbiturates exist it is not known how the combination of barbiturates and alcohol acts on folic acid metabolism. In thirty patients receiving barbiturates in excess in combination with alcohol, absorption of folic acid and its rate of disappearance were studied in the blood. Two series of studies were performed. In the first, folic acid (15 μg/kg of body weight) was administered orally and the maximum concentration in the blood as well as its disappearance rate were determined. In the second, folinic acid (15 μg/kg of body weight) was administered intramuscularly and the disappearance rate of folic acid was again determined. Blood samples were taken at certain intervals after administration of folic or folinic acid. Estimation of serum folic acid level was obtained by a competitive protein-binding technique using ^{3}HFA as tracer. The results are discussed and compared with those in normal subjects. (auth)

11878 RADIOIMMUNOLOGICAL RESEARCH INTO THE LEVEL OF BOVINE L. H. Ectors, F.; Hendrick, J. C.; Franchimont, P.; Derivaux, J. (Liege Univ. (Belgium)). Ann. Endocrinol. (Paris); 35: No. 4, 489-497(Jul 1974). (In French).

The level of bovine LH has been measured by radioimmunoassay by the use of the double antibody solid phase system. Using the cross reaction between LH of rat, sheep, pig, and cow, we have measured the bovine-LH with rat LH labelled and ovine-LH antiserum. This preceding radioimmunoassay appeared to be specific. The plasma concentrations in the cow are: the level is very low and practically constant during inter-estrous phase. The mean value is 1.5ng/ml; at the beginning of estrous, this level increases quickly to reach a medium peak value of 17.5ng/ml; this peak is remarkable during more or less 6 or 9 hours. During

pregnancy, LH levels are uniformly low: the average is 0.89ng/ml. The adult bull has a middle level of 2.6ng/ml (0.9 to 7.1ng/ml) and the ox has a middle level of 2.4ng/ml (0.8 to 4.07ng/ml). (FR)

11879 PERCUTANEOUS ABSORPTION IN VIVO OF ^{125}I-THYROXINE AND ^{125}I-TRIIODOTHYRONINE IN THE RAT. James, M.; Wepierre, J. (Paris-11 Univ., 92 - Chatenay-Malabry (France)). Ann. Pharm. Fr.; 32: No. 12, 633-640(1974). (In French).

When ^{125}I-thyroxine and ^{125}I-triiodothyronine are applied in alcoholic solution on the skin of the rat in vivo, they are absorbed through the percutaneous route without undergoing degradation. On application area (connective tissue and abdominal muscle), the two hormones accumulate and the concentrations measured are sufficient to provoke significant physiological effects. In contrast, thyroxine and triiodothyronine content remains very low in plasma and in the other organs. Ionophoresis provokes a tenfold increase of thyroxine penetration. (FR)

11880 UTILIZATION OF GLUCOSE ^{14}C(U) AND PHENYLALANINE ^{14}C(U) IN THE TWINING STEMS OF PERIPLOCA GRAECA L. Melin, Daniel (Besancon Univ., 25 (France)). C. R., Ser. D.; 280: No. 7, 845-848(17 Feb 1975). (In French).

The phenylalanine ^{14}C(U) is used more rapidly than the glucose ^{14}C(U) by the intermediate metabolism. In the two cases, the radioactivity is the greatest in the protein fraction. The protein biosynthesis is high in the growing tissues of twining stems of P. graeca L. The strong labelling of the sugars fraction by the phenylalanine ^{14}C gives evidence of the utilization of pentoses process. (FR)

11881 IN VITRO UPTAKE OF [^{3}H]-SEROTONIN (^{3}H-5-HT) IN THE AVIAN PINEAL ORGAN: HIGH RESOLUTION RADIOAUTOGRAPHIC STUDY IN THE DUCK. Collin, J. P.; Juillard, M. T. (Poitiers Univ., 86 (France)); Calas, Andre (Montpellier-2 Univ., 34 (France); CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Biologie). C. R., Ser. D.; 280: No. 7, 885-888(17 Feb 1975). (In French).

In vitro incorporation of [^{3}H]-5-hydroxytryptamine ([^{3}H]-serotonin=[^{3}H]-5-HT) occurred in the secretory rudimentary photoreceptors and in the sympathetic noradrenergic fibers. (FR)

11882 RADIOIMMUNOASSAY OF BOVINE PROGESTERONE. Beckers, J. F.; Ballman, P.; Ectors, F.; Derivaux, J. C. R., Ser. D.; 280: No. 3, 335-338(20 Jan 1975). (In French).

Radioimmunoassay determination of plasma progesterone in the cow without chromatographic purification was developed. The level ranged from 0.6ng/ml during estrus to 6.4ng/ml during the luteal phase. The progesterone level declined rapidly 48 to 72h before estrus beginning. (FR)

11883 STUDY OF RADICULAR ABSORPTION OF THE CACAO TREE USING A RADIOACTIVE TRACER UNDER SOUTH-CAMEROON ECOLOGICAL CONDITIONS. Massaux, F.; Misse, C. (Yaounde Univ. (Cameroon)); Gestin, A. J. (Institut Francais du Cafe, du Cacao et autres Plantes Stimulantes (I.F.C.C.), 75 - Paris (France)). Cafe, Cacao, The; 18: No. 4, 225-236(Oct 1974). (In French).

Radicular absorption of the cocoa tree was studied using a ^{32}P radioactive tracer. Migration of phosphates in the soil was studied. Three supply depths (5cm, 25cm, 45cm) were compared in a test comprising two replications. No phosphorus migration whatsoever was noted; as a result, the phosphate fertilizer must be placed within immediate reach of the roots. The results show that phosphorus absorption is optimum for a supply effected at a depth of 5cm and at a distance from the trunk of 80cm because of localization of the radicular system in the first centimeters of soil. The P_2O_5 contents of the leaves vary with their physiological age: young leaves take up almost three quarters of the total phosphorus absorbed. Absorption through the roots, the length of which is less than 125 cm, seems to benefit primarily young organs. As a result of this study, surface spreading of fertilizer can be recommended in a crown pattern the average radius of which will be 80cm. The fertilizer can be covered with mulch but must not be buried. A substantial absorption of phosphorus by the peripheral trees, not included in the experiment, was also shown to occur. (FR)

11884 CONTRIBUTION TO THE EARLY DIAGNOSIS OF SPLENIC RUPTURE USING RADIOACTIVE ISOTOPES. Marin Gorriz, F.; Barco Garcia, J.; Ascaso Bandres, A.; Garcia Lopez, F.; Banzo Marraco, J.; Millan Cebrian, S. (Zaragoza Univ. (Spain)). J. Radiol., Electrol., Med. Nucl.; 56: No. 1, 71-74 (Jan 1975). (In French).

Among the methods of early diagnosis of rupture and trauma of the spleen, fixation of radioactive isotopes is one of the most interesting. An experimental study in the dog of B.M.H.P. metabolism, using B.M.H.P. labelled with Hg-203 and its rate of elimination by the kidney, gives information on lesions of the spleen, in particular, subcapsular rupture. Splenic trauma reduces the capacity of uptake of mercury by this organ. Excretion in the urine then increases very definitely. This simple and inoffensive method should be used in man. (FR)

11885 GAS PHASE CHROMATOGRAPHIC DETERMINATION OF THE SPECIFIC RADIOACTIVITY OF ESTROGENS. Adessi, G.; Jayle, M. F. (Paris-5 Univ., 75 (France)). C. R. Ser. D.; 270: No. 26, 2143-2145(23 Dec 1974). (In French).

The technique described allows the specific radioactivity of very small quantities of labelled estrogens to be identified and determined by a simple modification of gas phase chromatograph. Because of its simplicity and high sensitivity the method can be used to study the metabolism of labelled estrogens in vivo or in vitro. (FR)

11886 SIMULTANEOUS LABELLING OF RANDOM AND COHORT POPULATION OF PLATELETS IN THE CIRCULATION OF THE RABBIT. Bhattacharya, D. K. (North Bengal Univ., Calcutta). Indian J. Exp. Biol.; 12: No. 6, 531-534(Nov 1974).

A method has been developed for the measurement of the platelet radioactivity when ^{32}P-DFP (^{32}P-diisopropyl phosphorofluoridate) and ^{14}C-serotonin or ^{35}S-sodium sulphate were used simultaneously to label the blood platelets in circulation. The ^{32}P-DFP and ^{14}C-serotonin label the cross section of the platelets, whereas ^{35}S-sodium sulphate labels a fixed population of the platelets at their origin in the bone marrow. The mean platelet life, determined by ^{32}P-DFP as a platelet label, is comparable, when ^{14}C-serotonin or ^{35}S-sodium sulphate was used, provided only the initial slope of the ^{32}P-DFP platelet radioactivity was taken into consideration. The similarity of the initial slopes of ^{32}P-DFP, ^{14}C-serotonin and ^{35}S-sodium sulphate labelled platelets suggest that the platelets are utilized or removed from circulation of the rabbit at random, irrespective of the age of the platelet. (auth)

11887 RADIOACTIVE ISOTOPE METHODS OF STUDYING PULMONARY BLOOD CIRCULATION IN INFANTS WITH HEART LESIONS. Zatevakhina, M. V. (Inst. of Cardiac-Vessel Surgery, Moscow). Vestn. Akad. Med. Nauk SSSR; 28: 21-24(1973). (In Russian).

Development of collateral (bronchial) pulmonary blood circulation in patients with congenital "blue" heart diseases is one of the main forms of compensation of an impoverished pulmonary blood flow. Estimation of the bronchial blood flow amount is connected with probing of all cardiac cavities and magistral vessels which is practically impossible in children of early age. The present work deals with a new method of regulation of the bronchial blood flow with the help of ^{131}I-macroaggregation of albumin and radiometry of the whole body with catheterization only of the aorta. There are no reports on similar investigations either in this country or abroad. Data on magnitude of the bronchial blood flow obtained by the authors are exceedingly valuable for estimation of a degree of compensation of the pulmonary blood flow prior to surgical interventions and for avoidance of possible pulmonary complications during the postoperative period. (auth)

11888 FUNCTION OF ERYTHROCYTES IN ATTACHING SELENITE-^{75}Se ONTO SPECIFIC PLASMA PROTEINS. Sandholm, M. (Coll. of Veterinary Medicine, Helsinki). Acta Pharmacol. Toxicol.; 36: 321-327(1975).

The binding of ^{75}Se-selenite onto human plasma proteins was studied in the presence and absence of erythrocytes. The binding proteins were detected by crossed immuno-electrophoresis followed by autoradiography. Human erythrocytes were shown to metabolize labelled selenite becoming bound to specific plasma proteins. The most heavily labelled proteins were the β-lipoprotein and an unidentified fraction located electrophoretically between the α_1 and α_2 globulin fractions. (DE)

11889 IN VIVO METABOLISM OF ^{14}C-LABELED PALMITIC ACID IN SERUM AND IN BROWN AND WHITE ADIPOSE TISSUES OF WELL-FED AND STARVED NEWBORN RABBITS. I. Tracer Kinetic Analysis of Free Fatty Acid Metabolism in Serum. Heim, T.; Schenk, H.; Wagner, H.; Winkler, L.; Goetze, E.; Varga, F. (Univ. of Pecs, Hungary). Biol. Neonate; 24: No. 5-6, 244-255 (1974).

After i. v. injection of $20 \cdot 10^6$ cpm/100 g body weight ^{14}C-1-palmitic acid at a thermoneutral environment (T_a35°C) the primary FFA pool was in 7 days old well fed rabbits (Group I) 9.57 μmole, and in rabbits of the same age but previously starved for 48 h at 20°C (group II) 3.17, and in those starved 72 h at 35°C (group III) 1.89. There was no significant difference in disappearance rate (λ) half time ($t_{0.5}$) and turnover time (t_t) indicating that the rate at which the label disappeared from the forerunner FFA pool was more dependent on the T_a maintained during the tracer kinetic experiment, than on the duration and the thermal conditions of the previous starvation. The absolute turnover rate of serum FFA (m_s) was 9.38 μmole FFA/min in group I and 3.44 and

2.67 in group II and group III, respectively; pointing out that the transfer of FFA from the forerunner pool into the fatty acid compartments of various organs and tissues was significantly reduced by starvation. (auth)

11890 NEUTRON RADIOGRAPHIC IMAGING OF THIN TISSUE SECTIONS. Bull, S. R. (Univ. of Michigan, Ann Arbor); Corwin, L. A.; Hammann, K. K.; Hori, J.; Schmit, D. J. Trans. Am. Nucl. Soc.; 21: 112-113(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11891 STUDY OF THE STATE OF WATER IN PLANTS USING HEAVY WATER (D_2O) AND THE NMR METHOD. Samuilov, F. D.; Nikiforova, V. I. (Gorky Agricultural Inst., USSR). Dokl. Bot. Sci.; 214-216: 26-28(1974).

Translated from Dokl. Akad. Nauk SSSR; 215: No. 3, 744-747 (Mar 1974).

Considering that experimental data in this field could be of interest for the elucidation of the question concerning the state of water in the cells, the present study, using the method of nuclear spin echo, aimed at the investigation of the changes in the state of water in the cells when replaced by heavy water (D_2O), as well as elucidation of the influence of such replacement on the entry of water into plants. On the basis of the data discussed a conclusion can be drawn that high concentrations of D_2O exert an influence on the state of water in plant cells, its structurization, cellular permeability, and, in the final analysis, on the rate of absorption and transfer of water in plants. (ERB)

11892 BONE SCINTIGRAPHIC AND RADIOLOGIC EXAMINATIONS OF TALUS FRACTURE HEALING. Cueni, T. A.; Allgoewer, M. (Univ., Basel). Helv. Chir. Acta; 41: No. 4, 459-468(Sep 1974).

After a short historical review of bone scintigraphy, a description is presented of a method for the counting of the scintigrams. Six cases following talus fractures were examined at various time intervals. The "normal course" of two functionally and morphologically well-healed cases showed that the values in the beginning were strongly increased and then slowly decreased without returning to normal even after a year. Therefore, the increased activity does not point to a necrosis. Examinations at a later time show activity increases that could result from inactivity osteoporosis and arthrosis. Among these cases, a talus necrosis was not found. The study points to the fact that the simple x ray with the signs of subchondral spotty osteoporose directly shows the vascularity of the bone and this helps in determination of the period of charge. (auth)

11893 COMPUTER PROGRAMS FOR RADIOCARDIOGRAPHY AND RADIOCYCLOGRAPHY. Korvath, M.; Szabo, D.; Tomor, B.; Almasi, L.; Ludvigh, K. Izotoptechnika.; 18: No. 4, 173-182 (Apr 1975). (In Hungarian).

Digital radiocardiography with linear programming, on ALGOL language, by means of an ODRA-1204 computer is described. Dynamic cardiac parameters of patients at rest and under stress are determined. The combination of nuclear methods with conventional cardiologic examinations, particularly microcatheterizing, is demonstrated. (ERB)

11894 CUMULATION OF GORDOX, LABELLED WITH RADIOIODINE AND THE BURDEN OF CRITICAL ORGANS. Farkas, G.; Kocsar, L.; Kutas, V. (Orszagos Frederic Joliot-Curie Sugarbiologiai es Sugaregeszsegugyi Kutato Intezet, Budapest). Izotoptechnika.; 18: No. 4, 165-172(Apr 1975). (In Hungarian).

The cumulative radiation doses to the whole body, blood, spleen, kidneys, and gonads of rats was determined following the administration of ^{125}I- of ^{131}I-labelled Gordox. Iodine-125- and iodine-131-v labelled Gordox is a new kidney scanning agent. (ERB)

11895 DIAGNOSTICS AND THERAPY USING NUCLEAR TECHNIQUES. Wagner, H. N. Jr. (Johns Hopkins Medical Institutions, Baltimore). pp 351-352 of Radiation Engineering in the Academic Curriculum. Vienna; International Atomic Energy Agency (1975).

From proceedings of a study group on radiation engineering in the academic curriculum; Haifa, Israel (27 Aug 1973). See STI/PUB-372; CONF-730866-.

A brief presentation is offered of points that have a bearing on the design of academic curricula as applied to the field of nuclear medicine. Statistics both on the wide use of nuclear medicine in the United States of America and on the training in medical schools are presented. (auth)

11896 COURSES RELATED TO MEDICAL RADIATION PHYSICS AND RADIATION ENGINEERING AT THE TECHNION. Shalev, S.; Tatcher, M.; Robinson, E. (TECHNION, Haifa, Israel). pp 353-355 of Radiation Engineering in the Academic Curriculum. Vienna; International Atomic Energy Agency (1975).

From proceedings of a study group on radiation engineering in the academic curriculum; Haifa, Israel (27 Aug 1973). See STI/PUB-372; CONF-730866-.

The planning and course curricula at the TECHNION offered in the School of Medicine and also in relatively small interdisciplinary units, among which are the Department of Nuclear Engineering and the Bio-medical Engineering Unit, are described. The results of the approaches taken are discussed. (auth)

11897 APPARENT VOLUMES OF DISTRIBUTION OF ^{125}I-IOTHALAMATE AND INULIN IN CHICKENS (38781). Harris, K. M.; Koike, T. I. (Univ. of Arkansas Medical Center, Little Rock). Proc. Soc. Exp. Biol. Med.; 149: No. 1, 242-247(May 1975).

The suitability of utilizing ^{125}I-iothalamate to estimate the volume of extracellular fluid was assessed in ureterally ligated chickens. Subsequent to intravenous administration the movement of labeled iothalamate from the plasma compartment follows closed two-compartment kinetics and equilibration between vascular and extravascular phases is attained in about 20 minutes. The volume of distribution of ^{125}I-iothalamate prior to and following the infusion of 0.15 M NaCl (equal to 15 percent of the estimated ECFV) averaged 23.6 +- 0.61 and 28.4 +- 0.22 percent of the body weight, respectively. The observed postsaline labeled iothalamate space did not differ statistically from the expected value. When administered simultaneously inulin penetrates into an apparent volume that is 75 percent of the labeled iothalamate space after 60 minutes. The content of ^{125}I-iothalamate is relatively high in liver and kidney tissue and suggests that these are major sites where removal of the indicator from plasma occur. It is suggested that ^{125}I-iothalamate, under appropriate conditions, could be used to measure the plasma volume and the extravascular fluid with which plasma is in rapid diffusion equilibrium. (auth)

11898 RADIOACTIVE RUTHENIUM RED ACCUMULATION BY TUMORS: A POTENTIAL SCANNING AGENT. Anghileri, L. J. (Essen Univ. (Gesamthochschule) (F. R. Germany). Innere Klinik und Poliklinik-Tumorforschung). Strahlentherapie; 149: No. 2, 173-175(1975).

The distribution of ^{103}Ru-ruthenium red in tumor-bearing animals indicates that ruthenium red labelled with radioruthenium shows the characteristics of a tumor scanning agent. Its accumulation seems to be related to its specific binding to mucopolysaccharides. In addition, this radiocompound shows a potential value in the study of other pathological states involving the metabolism of mucopolysaccharides and glycoproteins. (auth)

11899 POSSIBILITIES FOR THE USE OF INHALATION SCINTIGRAPHY BY MEANS OF RADIOAEROSOLS. Otto, R. (Kantonsspital Winterthur (Switzerland). Radiologisches Inst.). Roentgen Bl.; 28: No. 3, 108-120(Mar 1975). (In German).

The information, which is given by conventional perfusion scans of the lungs, is significantly expanded by the inhalation scintiscan using radioaerosols. The definite proof of pulmonary embolism by scan is only possible in combined examination of lung perfusion and ventilation. In addition the inhalationscan offers significant clues to the existence of alterations such as radiologically invisible chronic bronchitis and even allows for the definition of an emphysematous reorganization of the bronchial stenosis itself. The employment of the method for early diagnosis of bronchial carcinoma is conceivable. The investigation can be done routinely by means of conventional scanners and an ultrasound nebulizer without great expenditure. The use of this technique is even feasible in dyspnoic patients who are not able to hold their breath for dynamic ventilation studies when using radioxenon and a scintillation camera. (auth)

11900 DEFECTIVE MONONUCLEAR LEUKOCYTE CHEMOTAXIS IN THE CHEDIAK-HIGASHI SYNDROME OF HUMANS, MINK, AND CATTLE. Gallin, J. I.; Klimerman, J. A.; Padgett, G. A.; Wolff, S. M. (National Inst. of Allergy and Infectious Diseases, Bethesda, MD). Blood; 45: No. 6, 863-870(Jun 1975).

Chemotaxis of mononuclear leukocytes from humans, mink, and cattle was evaluated in vitro using a morphologic Boyden chamber technique and a new ^{51}Cr-labeled mononuclear radioassay with a double micropore filter system. Significantly decreased mononuclear leukocyte chemotactic responses were noted when human, mink, or cattle Chediak-Higashi cells were tested using autologous serum or endotoxin-activated autologous serum. A similar Chediak-Higashi mononuclear leukocyte defect was noted in humans when kallikrein or dialyzable transfer factor were used as the chemotactic stimulus. Studies using smaller pore filters in the chemotactic chamber exaggerated the chemotactic defect. Serum from Chediak-Higashi subjects had normal chemotactic activity. Additional studies on the spontaneous

(random) locomotion of Chediak-Higashi mononuclear leukocytes revealed normal results when a capillary tube assay system was used, but abnormal results were obtained when a Boyden chamber micropore filter assay was used, demonstrating fundamental differences in these two assays of random locomotion. It is clear from these studies that defective mononuclear leukocyte chemotaxis is another feature of the impaired host defenses in the Chediak-Higashi syndrome that may contribute to the marked susceptibility to pyogenic infections so characteristic of this disease. (auth)

11901 PHOSPHATASES. XII. Isoenzymes of Alkaline Phosphatase and Radionuclear Investigation (^{85}Sr) of Patients With Neoplastic Affection of the Skeleton. Stepan, J.; Konopasek, B.; Bek, V.; Kolar, J.; Jakoubkova, J. (Charles Univ., Prague). Neoplasma; 22: No. 2, 201-210(1975).

In a group of 30 patients with neoplastic processes, 13 were found to have a significantly increased serum alkaline phosphatase activity. This finding correlated with the results of investigation with ^{85}Sr in 7 patients, but owing to a concomitant hepatal symptomatology, it proved of differential diagnostic value in only one of them. On the other hand, the activity of bone isoenzyme of alkaline phosphatase was significantly altered in 15 patients. In 14 of them the increase in bone isoenzyme activity corresponded to an x-ray and a radionuclear finding of a tumor process in the bones. This activity was within the normal range of values in only one patient with a positive result of the ^{85}Sr investigation. An agreement between the results of determination of bone isoenzyme activity of alkaline phosphatase and those of radionuclear investigations was found in 27 patients. In addition, a correlation was established between the increased activity of bone isoenzyme and that of intestinal isoenzyme of alkaline phosphatase. Enzyme investigation can be suitably utilized, alongside radionuclear examination, for early detection of a bone process. (auth)

11902 HEPATITIS B CORE ANTIGEN: DETECTION OF ANTIBODY BY RADIOIMMUNOPRECIPITATION. Moritsugu, Y. (National Inst. of Allergy and Infectious Diseases, Bethesda, MD); Gold, J. W. M.; Wagner, J.; Dodd, R. Y.; Purcell, R. H. J. Immunol.; 114: No. 6, 1792-1798(Jun 1975).

Radioactive cores were prepared from concentrated Dane particles by DNA polymerase reaction followed by CsCl density gradient centrifugation. Two radioactive peaks were obtained: one peak with an average density of 1.36 g/cm^3 in CsCl contained cores that possessed full serologic reactivity; the other peak, with a density of 1.28 to 1.32 g/cm^3, contained cores associated with globulin. A double antibody immunoprecipitation test was developed, using the radioactive heavy cores as a source of antigen. The test was at least 300 times as sensitive as complement fixation for detecting antibody to core. (auth)

11903 BONE SCANNING: OSTEOGENIC SARCOMA. Correlation With Surgical Pathology. Goldman, A. B.; Becker, M. H.; Braunstein, P.; Francis, K. C.; Genieser, N. B.; Firooznia, H. (New York Univ. Hospital). Am. J. Roentgenol., Radium Ther. Nucl. Med.; 124: No. 1, 83-90(May 1975).

From 75th annual meeting of the American Roentgen Ray Society; San Francisco, CA (24 Sep 1974).

This study was designed to evaluate the role of isotopic scanning in determining the local extension of osteosarcoma. During the period of the study, 13 patients with biopsy proven osteosarcomas were evaluated. The results indicated that in no case did the isotope scan demonstrate greater intramedullary extension of tumor than the routine roentgenographic examination. In addition, despite good correlation between the roentgenogram, scan, and histologic evaluation of tumor extent, all of which showed no evidence of malignancy near the area of surgery, there have been to date 3 local recurrences. (auth)

11904 RADIOIMMUNOASSAY FOR PLASMA 20 alpha-DIHYDROPROGESTERONE. Maroulis, G. B.; Abraham, G. E. (Harbor General Hospital, Torrance, CA). Anal. Lett.; 8: No. 6, 377-385 (1975).

A radioimmunoassay method for the measurement of 20alpha-dihydroprogesterone (20 alpha-P) in plasma is described. Utilizing a specific antiserum for 20alpha-P with a one-step Celite microcolumn chromatographic system, this steroid was measured in small aliquots of plasma from both male and female subjects. In 10 men, the mean 20alpha-P level was 0.85 ng/ml. In six premenopausal women studied during one complete menstrual cycle, the mean levels during the follicular and luteal phases were respectively 0.63 and 3.7 ng/ml. These values are within the range of levels reported by one group of investigators but higher than those reported by another group. (auth)

11905 RADIOLOGIC DIAGNOSIS OF PANCREATIC CANCER. Roesch, J. (Univ. of Oregon, Portland). J. Surg. Oncol.; 7: No. 2, 121-133(1975).

Modern radiology makes possible an accurate diagnosis of pancreatic cancer in about 95 percent of cases. Conventional upper gastrointestinal study, isotopic (^{75}Se-selenomethionine) scanning, hypotonic duodenography, and ultrasonography are suitable as screening procedures. Special methods of high accuracy, such as pancreatic arteriography, endoscopic pancreatography, and transhepatic cholangiography, are used as needed for definitive diagnosis. (auth)

11906 COMPARATIVE INHIBITORY EFFECTS OF ANTIGEN AND ANTIBODY IN THE STAPHYLOCOCCAL ENTERTOXIN SOLID-PHASE RADIOIMMUNOASSAY SYSTEM. Bukovic, J. A.; Johnson, H. M.; Peeler, J. T. (Dept. of Health, Education, and Welfare, Cincinnati). Appl. Microbiol.; 29: No. 6, 765-768(Jun 1975).

A solid-phase radioimmunoassay employing ^{125}I-labeled enterotoxins and polystyrene tubes coated with specific antibody has been developed for assaying the relative concentrations of antibodies to staphylococcal enterotoxins A and B. Competitive binding occurs between tube-bound antibody and free antibody for binding sites on ^{125}I-labeled enterotoxin. The sensitivity of the system is affected by the amount of antibody on the walls of the tubes, the concentration of ^{125}I-labeled enterotoxin added to the system, and probably by the relative binding affinities of the bound and unbound antibodies. Antibody, 0.01 to 0.07 mu g/ml, inhibited the uptake of ^{125}I-labeled enterotoxin by 20 percent. Both the antibody and antigen solid-phase radioimmunoassay inhibition systems can be appropriately represented by either of the following two models: Log/sub e/ $(Y/1 - Y)$ equals $alpha_0 + alpha_1$ Log/sub e/X and Log/sub e/Y equals $beta_0 + beta_1$ Log/sub e/X, where Y is bound activity, X is antigen or antibody concentration for inhibition , and $alpha_0$, $alpha_1$, $beta_0$, and $beta_1$ are regression coefficients. Estimates from the first model were slightly more precise for the antibody system, whereas the reverse was true for the antigen system. (auth)

11907 STABILITY OF ^{125}I-LABELED STAPHYLOCOCCAL ENTEROTOXINS IN SOLID-PHASE RADIOIMMUNOASSAY. Kauffman, P. E.; Johnson, H. M. (Dept. of Health, Education, and Welfare, Cincinnati). (Appl. Microbiol.; 29: No. 6, 776-779(Jun 1975).

Staphylococcal enterotoxins, Types A, B, and C, were labeled with ^{125}I by the chloramine-T method at approximately two levels of specific activity, 40 and 4 muCi/mu g of protein. Toxins labeled with high specific activity showed extensive dissociation of ^{125}I when stored at different temperatures, including -23^0C. In contrast, toxins labeled with low specific activity did not show any significant loss of ^{125}I when stored at -23^0C for as long as 2 months. Enterotoxins, whether labeled with high or low activities, formed aggregates immediately upon labeling. Aggregate formation increased in high-activity-labeled toxins on storage at -23^0C and low-activity-labeled toxins showed no significant increase in aggregate formation, even after 2 months at -23^0C. The aggregated forms of the enterotoxins were either devoid of antigenic activity in solid-phase radioimmunoassay or they possessed significantly reduced antigenic activity. Thus, a decrease in binding of ^{125}I-labeled enterotoxin to specific antibody in solid-phase radioimmunoassay results mainly from loss of ^{125}I on storage, and formation of aggregates with reduced antigenic activity. (auth)

11908 STUDIES ON A RADIOIMMUNOASSAY FOR HUMAN ERYTHROPOIETIN. Lertora, J. J. L.; Dargon, P. A.; Rege, A. B.; Fisher, J. W. (Tulane Univ., New Orleans). J. Lab. Clin. Med.; 86: No. 1, 140-151(Jul 1975).

A highly purified erythropoietin (ESF) preparation (12,000 units per milligram of protein) was labeled with Na ^{125}I using the Chloramine-T method. Undamaged immunoreactive labeled ESF was separated from the damaged, nonimmunologically reactive ESF by Sephadex G-150 fractionation. This undamaged immunoreactive ESF was used in a radioimmunoassay for human erythropoietin. Separation of bound from free antigen was achieved using the double-antibody technique. Approximately 55 percent binding was observed at an antiserum dilution of 1:1500. This assay appears to be sensitive enough to detect as little as 0.025 milliunits of the International Reference Preparation erythropoietin. The estimated levels of this hormone in normal and anemic uremic human subjects suggest that immunoreactive serum erythropoietin levels are elevated above normal in anemia of uremia. (auth)

11909 DIFFERENTIAL PULMONARY RESIDUAL VOLUME DETERMINATIONS WITH RADIOACTIVE XENON. Serino, T.; MacDonnell, K. F.; Ishikawa, S.; Braverman, L.; Abreau, C. M.; Johnston, R. P.; Cloonan, E. (St. Elizabeth's Hospital, Boston). J. Lab. Clin. Med.; 86: No. 1, 160-163(Jul 1975).

A radioactive xenon inhalation procedure was used to determine differential residual volumes (right lung vs. left lung) in 28 normal subjects (6 of whom smoked approximately 1 package of cigarettes per day). The average right lung residual volume represented 54 percent of the total residual volume, whereas the average left lung

2.67 in group II and group III, respectively; pointing out that the transfer of FFA from the forerunner pool into the fatty acid compartments of various organs and tissues was significantly reduced by starvation. (auth)

11890 NEUTRON RADIOGRAPHIC IMAGING OF THIN TISSUE SECTIONS. Bull, S. R. (Univ. of Michigan, Ann Arbor); Corwin, L. A.; Hammann, K. K.; Hori, J.; Schmit, D. J. Trans. Am. Nucl. Soc.; 21: 112-113(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11891 STUDY OF THE STATE OF WATER IN PLANTS USING HEAVY WATER (D_2O) AND THE NMR METHOD. Samuilov, F. D.; Nikiforova, V. I. (Gorky Agricultural Inst., USSR). Dokl. Bot. Sci.; 214-216: 26-28(1974).

Translated from Dokl. Akad. Nauk SSSR; 215: No. 3, 744-747 (Mar 1974).

Considering that experimental data in this field could be of interest for the elucidation of the question concerning the state of water in the cells, the present study, using the method of nuclear spin echo, aimed at the investigation of the changes in the state of water in the cells when replaced by heavy water (D_2O), as well as elucidation of the influence of such replacement on the entry of water into plants. On the basis of the data discussed a conclusion can be drawn that high concentrations of D_2O exert an influence on the state of water in plant cells, its structurization, cellular permeability, and, in the final analysis, on the rate of absorption and transfer of water in plants. (ERB)

11892 BONE SCINTIGRAPHIC AND RADIOLOGIC EXAMINATIONS OF TALUS FRACTURE HEALING. Cueni, T. A.; Allgoewer, M. (Univ., Basel). Helv. Chir. Acta; 41: No. 4, 459-468(Sep 1974).

After a short historical review of bone scintigraphy, a description is presented of a method for the counting of the scintigrams. Six cases following talus fractures were examined at various time intervals. The "normal course" of two functionally and morphologically well-healed cases showed that the values in the beginning were strongly increased and then slowly decreased without returning to normal even after a year. Therefore, the increased activity does not point to a necrosis. Examinations at a later time show activity increases that could result from inactivity osteoporosis and arthrosis. Among these cases, a talus necrosis was not found. The study points to the fact that the simple x ray with the signs of subchondral spotty osteoporose directly shows the vascularity of the bone and this helps in determination of the period of charge. (auth)

11893 COMPUTER PROGRAMS FOR RADIOCARDIOGRAPHY AND RADIOCYCLOGRAPHY. Korvath, M.; Szabo, D.; Tomor, B.; Almasi, L.; Ludvigh, K. Izotoptechnika.; 18: No. 4, 173-182 (Apr 1975). (In Hungarian).

Digital radiocardiography with linear programming, on ALGOL language, by means of an ODRA-1204 computer is described. Dynamic cardiac parameters of patients at rest and under stress are determined. The combination of nuclear methods with conventional cardiologic examinations, particularly microcatheterizing, is demonstrated. (ERB)

11894 CUMULATION OF GORDOX, LABELLED WITH RADIOIODINE AND THE BURDEN OF CRITICAL ORGANS. Farkas, G.; Kocsar, L.; Kutas, V. (Orszagos Frederic Joliot-Curie Sugarbiologiai es Sugaregeszsegugyi Kutato Intezet, Budapest). Izotoptechnika.; 18: No. 4, 165-172(Apr 1975). (In Hungarian).

The cumulative radiation doses to the whole body, blood, spleen, kidneys, and gonads of rats was determined following the administration of ^{125}I- of ^{131}I-labelled Gordox. Iodine-125- and iodine-131-v labelled Gordox is a new kidney scanning agent. (ERB)

11895 DIAGNOSTICS AND THERAPY USING NUCLEAR TECHNIQUES. Wagner, H. N. Jr. (Johns Hopkins Medical Institutions, Baltimore). pp 351-352 of Radiation Engineering in the Academic Curriculum. Vienna; International Atomic Energy Agency (1975).

From proceedings of a study group on radiation engineering in the academic curriculum; Haifa, Israel (27 Aug 1973). See STI/PUB-372; CONF-730866-.

A brief presentation is offered of points that have a bearing on the design of academic curricula as applied to the field of nuclear medicine. Statistics both on the wide use of nuclear medicine in the United States of America and on the training in medical schools are presented. (auth)

11896 COURSES RELATED TO MEDICAL RADIATION PHYSICS AND RADIATION ENGINEERING AT THE TECHNION. Shalev, S.; Tatcher, M.; Robinson, E. (TECHNION, Haifa, Israel). pp 353-355 of Radiation Engineering in the Academic Curriculum. Vienna; International Atomic Energy Agency (1975).

From proceedings of a study group on radiation engineering in the academic curriculum; Haifa, Israel (27 Aug 1973). See STI/PUB-372; CONF-730866-.

The planning and course curricula at the TECHNION offered in the School of Medicine and also in relatively small interdisciplinary units, among which are the Department of Nuclear Engineering and the Bio-medical Engineering Unit, are described. The results of the approaches taken are discussed. (auth)

11897 APPARENT VOLUMES OF DISTRIBUTION OF ^{125}I-LOTHALAMATE AND INULIN IN CHICKENS (38781). Harris, K. M.; Koike, T. I. (Univ. of Arkansas Medical Center, Little Rock). Proc. Soc. Exp. Biol. Med.; 149: No. 1, 242-247(May 1975).

The suitability of utilizing ^{125}I-iothalamate to estimate the volume of extracellular fluid was assessed in ureterally ligated chickens. Subsequent to intravenous administration the movement of labeled iothalamate from the plasma compartment follows closed two-compartment kinetics and equilibration between vascular and extravascular phases is attained in about 20 minutes. The volume of distribution of ^{125}I-iothalamate prior to and following the infusion of 0.15 M NaCl (equal to 15 percent of the estimated ECFV) averaged 23.6 +- 0.61 and 28.4 +- 0.22 percent of the body weight, respectively. The observed postsaline labeled iothalamate space did not differ statistically from the expected value. When administered simultaneously inulin penetrates into an apparent volume that is 75 percent of the labeled iothalamate space after 60 minutes. The content of ^{125}I-iothalamate is relatively high in liver and kidney tissue and suggests that these are major sites where removal of the indicator from plasma occur. It is suggested that ^{125}I-iothalamate, under appropriate conditions, could be used to measure the plasma volume and the extravascular fluid with which plasma is in rapid diffusion equilibrium. (auth)

11898 RADIOACTIVE RUTHENIUM RED ACCUMULATION BY TUMORS: A POTENTIAL SCANNING AGENT. Anghileri, L. J. (Essen Univ. (Gesamthochschule) (F. R. Germany). Innere Klinik und Poliklinik-Tumorforschung). Strahlentherapie; 149: No. 2, 173-175(1975).

The distribution of ^{103}Ru-ruthenium red in tumor-bearing animals indicates that ruthenium red labelled with radioruthenium shows the characteristics of a tumor scanning agent. Its accumulation seems to be related to its specific binding to mucopolysaccharides. In addition, this radiocompound shows a potential value in the study of other pathological states involving the metabolism of mucopolysaccharides and glycoproteins. (auth)

11899 POSSIBILITIES FOR THE USE OF INHALATION SCINTIGRAPHY BY MEANS OF RADIOAEROSOLS. Otto, R. (Kantonsspital Winterthur (Switzerland). Radiologisches Inst.). Roentgen Bl.; 28: No. 3, 108-120(Mar 1975). (In German).

The information, which is given by conventional perfusion scans of the lungs, is significantly expanded by the inhalation scintiscan using radioaerosols. The definite proof of pulmonary embolism by scan is only possible in combined examination of lung perfusion and ventilation. In addition the inhalationscan offers significant clues to the existence of alterations such as radiologically invisible chronic bronchitis and even allows for the definition of an emphysematous reorganization of the bronchial stenosis itself. The employment of the method for early diagnosis of bronchial carcinoma is conceivable. The investigation can be done routinely by means of conventional scanners and an ultrasound nebulizer without great expenditure. The use of this technique is even feasible in dyspnoic patients who are not able to hold their breath for dynamic ventilation studies when using radioxenon and a scintillation camera. (auth)

11900 DEFECTIVE MONONUCLEAR LEUKOCYTE CHEMOTAXIS IN THE CHEDIAK-HIGASHI SYNDROME OF HUMANS, MINK, AND CATTLE. Gallin, J. I.; Klimerman, J. A.; Padgett, G. A.; Wolff, S. M. (National Inst. of Allergy and Infectious Diseases, Bethesda, MD). Blood; 45: No. 6, 863-870(Jun 1975).

Chemotaxis of mononuclear leukocytes from humans, mink, and cattle was evaluated in vitro using a morphologic Boyden chamber technique and a new ^{51}Cr-labeled mononuclear radioassay with a double micropore filter system. Significantly decreased mononuclear leukocyte chemotactic responses were noted when human, mink, or cattle Chediak-Higashi cells were tested using autologous serum or endotoxin-activated autologous serum. A similar Chediak-Higashi mononuclear leukocyte defect was noted in humans when kallikrein or dialyzable transfer factor were used as the chemotactic stimulus. Studies using smaller pore filters in the chemotactic chamber exaggerated the chemotactic defect. Serum from Chediak-Higashi subjects had normal chemotactic activity. Additional studies on the spontaneous

(random) locomotion of Chediak-Higashi mononuclear leukocytes revealed normal results when a capillary tube assay system was used, but abnormal results were obtained when a Boyden chamber micropore filter assay was used, demonstrating fundamental differences in these two assays of random locomotion. It is clear from these studies that defective mononuclear leukocyte chemotaxis is another feature of the impaired host defenses in the Chediak-Higashi syndrome that may contribute to the marked susceptibility to pyogenic infections so characteristic of this disease. (auth)

11901 PHOSPHATASES. XII. Isoenzymes of Alkaline Phosphatase and Radionuclear Investigation (^{85}Sr) of Patients With Neoplastic Affection of the Skeleton. Stepan, J.; Konopasek, B.; Bek, V.; Kolar, J.; Jakoubkova, J. (Charles Univ., Prague). Neoplasma; 22: No. 2, 201-210(1975).

In a group of 30 patients with neoplastic processes, 13 were found to have a significantly increased serum alkaline phosphatase activity. This finding correlated with the results of investigation with ^{85}Sr in 7 patients, but owing to a concomitant hepatal symptomatology, it proved of differential diagnostic value in only one of them. On the other hand, the activity of bone isoenzyme of alkaline phosphatase was significantly altered in 15 patients. In 14 of them the increase in bone isoenzyme activity corresponded to an x-ray and a radionuclear finding of a tumor process in the bones. This activity was within the normal range of values in only one patient with a positive result of the ^{85}Sr investigation. An agreement between the results of determination of bone isoenzyme activity of alkaline phosphatase and those of radionuclear investigations was found in 27 patients. In addition, a correlation was established between the increased activity of bone isoenzyme and that of intestinal isoenzyme of alkaline phosphatase. Enzyme investigation can be suitably utilized, alongside radionuclear examination, for early detection of a bone process. (auth)

11902 HEPATITIS B CORE ANTIGEN: DETECTION OF ANTIBODY BY RADIOIMMUNOPRECIPITATION. Moritsugu, Y. (National Inst. of Allergy and Infectious Diseases, Bethesda, MD); Gold, J. W. M.; Wagner, J.; Dodd, R. Y.; Purcell, R. H. J. Immunol.; 114: No. 6, 1792-1798(Jun 1975).

Radioactive cores were prepared from concentrated Dane particles by DNA polymerase reaction followed by CsCl density gradient centrifugation. Two radioactive peaks were obtained: one peak with an average density of 1.36 g/cm^3 in CsCl contained cores that possessed full serologic reactivity; the other peak, with a density of 1.28 to 1.32 g/cm^3, contained cores associated with globulin. A double antibody immunoprecipitation test was developed, using the radioactive heavy cores as a source of antigen. The test was at least 300 times as sensitive as complement fixation for detecting antibody to core. (auth)

11903 BONE SCANNING: OSTEOGENIC SARCOMA. Correlation With Surgical Pathology. Goldman, A. B.; Becker, M. H.; Braunstein, P.; Francis, K. C.; Genieser, N. B.; Firooznia, H. (New York Univ. Hospital). Am. J. Roentgenol., Radium Ther. Nucl. Med.; 124: No. 1, 83-90(May 1975).

From 75th annual meeting of the American Roentgen Ray Society; San Francisco, CA (24 Sep 1974).

This study was designed to evaluate the role of isotopic scanning in determining the local extension of osteosarcoma. During the period of the study, 13 patients with biopsy proven osteosarcomas were evaluated. The results indicated that in no case did the isotope scan demonstrate greater intramedullary extension of tumor than the routine roentgenographic examination. In addition, despite good correlation between the roentgenogram, scan, and histologic evaluation of tumor extent, all of which showed no evidence of malignancy near the area of surgery, there have been to date 3 local recurrences. (auth)

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A radioimmunoassay method for the measurement of 20alpha-dihydroprogesterone (20 alpha-P) in plasma is described. Utilizing a specific antiserum for 20alpha-P with a one-step Celite microcolumn chromatographic system, this steroid was measured in small aliquots of plasma from both male and female subjects. In 10 men, the mean 20alpha-P level was 0.85 ng/ml. In six premenopausal women studied during one complete menstrual cycle, the mean levels during the follicular and luteal phases were respectively 0.63 and 3.7 ng/ml. These values are within the range of levels reported by one group of investigators but higher than those reported by another group. (auth)

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A solid-phase radioimmunoassay employing ^{125}I-labeled enterotoxins and polystyrene tubes coated with specific antibody has been developed for assaying the relative concentrations of antibodies to staphylococcal enterotoxins A and B. Competitive binding occurs between tube-bound antibody and free antibody for binding sites on ^{125}I-labeled enterotoxin. The sensitivity of the system is affected by the amount of antibody on the walls of the tubes, the concentration of ^{125}I-labeled enterotoxin added to the system, and probably by the relative binding affinities of the bound and unbound antibodies. Antibody, 0.01 to 0.07 mu g/ml, inhibited the uptake of ^{125}I-labeled enterotoxin by 20 percent. Both the antibody and antigen solid-phase radioimmunoassay inhibition systems can be appropriately represented by either of the following two models: Log/sub e/ (Y/1 – Y) equals $alpha_0 + alpha_1$ Log/sub e/X and Log/sub e/Y equals $beta_0 + beta_1$ Log/sub e/X, where Y is bound activity, X is antigen or antibody concentration for inhibition , and $alpha_0$, $alpha_1$, $beta_0$, and $beta_1$ are regression coefficients. Estimates from the first model were slightly more precise for the antibody system, whereas the reverse was true for the antigen system. (auth)

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Staphylococcal enterotoxins, Types A, B, and C, were labeled with ^{125}I by the chloramine-T method at approximately two levels of specific activity, 40 and 4 muCi/mu g of protein. Toxins labeled with high specific activity showed extensive dissociation of ^{125}I- when stored at different temperatures, including –23°C. In contrast, toxins labeled with low specific activity did not show any significant loss of ^{125}I when stored at –23°C for as long as 2 months. Enterotoxins, whether labeled with high or low activities, formed aggregates immediately upon labeling. Aggregate formation increased in high-activity-labeled toxins on storage at –23°C and low-activity-labeled toxins showed no significant increase in aggregate formation, even after 2 months at –23°C. The aggregated forms of the enterotoxins were either devoid of antigenic activity in solid-phase radioimmunoassay or they possessed significantly reduced antigenic activity. Thus, a decrease in binding of ^{125}I-labeled enterotoxin to specific antibody in solid-phase radioimmunoassay results mainly from loss of ^{125}I on storage, and formation of aggregates with reduced antigenic activity. (auth)

11908 STUDIES ON A RADIOIMMUNOASSAY FOR HUMAN ERYTHROPOIETIN. Lertora, J. J. L.; Dargon, P. A.; Rege, A. B.; Fisher, J. W. (Tulane Univ., New Orleans). J. Lab. Clin. Med.; 86: No. 1, 140-151(Jul 1975).

A highly purified erythropoietin (ESF) preparation (12,000 units per milligram of protein) was labeled with Na ^{125}I using the Chloramine-T method. Undamaged immunoreactive labeled ESF was separated from the damaged, nonimmunologically reactive ESF by Sephadex G-150 fractionation. This undamaged immunoreactive ESF was used in a radioimmunoassay for human erythropoietin. Separation of bound from free antigen was achieved using the double-antibody technique. Approximately 55 percent binding was observed at an antiserum dilution of 1:1500. This assay appears to be sensitive enough to detect as little as 0.025 milliunits of the International Reference Preparation erythropoietin. The estimated levels of this hormone in normal and anemic uremic human subjects suggest that immunoreactive serum erythropoietin levels are elevated above normal in anemia of uremia. (auth)

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A radioactive xenon inhalation procedure was used to determine differential residual volumes (right lung vs. left lung) in 28 normal subjects (6 of whom smoked approximately 1 package of cigarettes per day). The average right lung residual volume represented 54 percent of the total residual volume, whereas the average left lung

residual volume represented 46 percent of the total. In addition, all of the subjects were studied by a standard helium dilution technique and found to have total lung residual volumes comparable to the total lung residual volumes as determined by the xenon technique. There was no statistical difference between the data obtained from cigarette smokers vs. nonsmokers. The noninvasive nature of the xenon technique makes this a useful procedure in determining differential residual volumes. (auth)

11910 RADIOPHOSPHATE ($^{32}PO_4$) INCORPORATION INTO PHOSPHATIDIC ACID OF LEAD-POISONED AND NORMAL RED CELLS. Westerman, M. P.; Jensen, W. N. (Mt. Sinai Hospital, Chicago). Proc. Soc. Exp. Biol. Med.; 149: No. 2, 325-329(Jun 1975).

Radiophosphate incorporation into phosphatidic acid is decreased in the red cells of lead-poisoned humans and rabbits. The decrease in activity is not related to the length of red cell survival nor to the differences in osmotic fragility observed in the lead-poisoned cells. Incorporation of radiophosphate into phosphatidic acid of normal red cells is sulfhydryl dependent and occurs at the cell surface. Lipid composition of the red cell membrane of the lead-poisoned humans and rabbits is normal. (auth)

11911 PREPARATION OF BIOLOGICALLY ACTIVE ^{125}I LH-RH SUITABLE FOR MEMBRANE-BINDING STUDIES. Marshall, J. C.; Odell, W. D. (Univ. of California, Torrance). Proc. Soc. Exp. Biol. Med.; 149: No. 2, 351-355(Jun 1975).

The purpose of the study was to prepare biologically active ^{125}I LH-RH free of carrier hormone that would be suitable for both immunological and pituitary cell membrane-binding studies. The methodology described enables the preparation of stable ^{125}I-LH-RH suitable for the designated studies that offers considerable advantage over tritiated material. (ERB)

11912 REACTION OF PLASMIC DEGRADATION PRODUCTS OF FIBRINOGEN IN THE RADIOIMMUNOASSAY OF HUMAN FIBRINOPEPTIDE A. Budzynski, A. Z.; Marder, V. J.; Sherry, S. (Temple Univ. Health Sciences Center, Philadelphia). Blood; 45: No. 6, 757-768(Jun 1975).

A radioimmunoassay (RIA) technique has been devised for the measurement of human fibrinopeptide A (FPA). The system utilizes rabbit antiserum to native human FPA and a synthetic fibrinopeptide, with tyrosine substituted for phenylanine in amino acid position 8. The test detects native human FPA at a concentration of 0.1 ng/ml, but does not cross react with human fibrinopeptide B or with fibrinopeptides A from canine, porcine, or bovine fibrinogen. Fibrinogen and chemical or plasmic degradation products with 2 moles of FPA per mole react fully in this test system. This includes the large-molecular-weight intermediate fragments X and Y and theNH_2-terminal disulfide knot, and indicates that this antibody recognizes and reacts with FPA in the presence of the contiguous peptide structures presents in fibrinogen. Fragment E, which is derived from the NH_2-terminal portion of fibrinogen, loses most of its FPA content after its liberation from its precursor derivative and reacts to a lesser extent in the RIA than do fragments X and Y. This correlates with the recovery of FPA-positive material from ultrafiltrates of extensive but not partial plasmic digests of fibrinogen. Although FPA immunoreactivity liberated from fibrinogen does not necessarily reflect thrombin activity and/or fibrin formation, only extensive plasmic degradation yields peptide material which reacts in this RIA system. This should not be a serious limitation to the application of the RIA in the detection of venous thrombosis. (auth)

11913 METABOLIC EFFECTS OF ANTISICKLING AMOUNTS OF NITROGEN AND NOR-NITROGEN MUSTARD ON RABBIT AND HUMAN ERYTHROCYTES. Roth, E. F. Jr.; Nagel, R. L.; Neuman, G.; Vanderhoff, G.; Kaplan, B. H.; Jaffe, E. R. (Albert Einstein College of Medicine, Bronx, NY). Blood; 45: No. 6, 779-788(Jun 1975).

Nitrogen mustard (HN_2) and Nor-nitrogen mustard (Nor-HN_2) both inhibit the polymerization of deoxyhemoglobin S in solution and in intact erythrocytes. Metabolic studies were undertaken to determine the feasability of an extracorporeal treatment with these or related agents. Glucose utilization, hexose monophosphate shunt activity, methemoglobin reduction, and incubation with acetylphenyl hydrazine for Heinz body formation were performed, as well as specific assays for hexokinase, pyruvate kinase, glucose-6-phosphate dehydrogenase, glutathione reductase, ATP, reduced glutathione (GSH), and survival of autologous mustard-treated cells in rabbits. HN_2 was found to enter red cells rapidly and bind to intracellular contents. Metabolic studies revealed no significant inhibition or alteration of function by Nor-HN_2 at 10 mg/ml of whole blood. Rabbit red cell survival was also normal. HN_2, however, inhibited glutathione reductase and blocked the free sulfhydryl group of GSH by forming several addition products of alkylated GSH. Heinz body test with acetylphenylhydrazine became positive in HN_2-treated cells, and rabbit red cell survival was shortened considerably in the concentration range used to inhibit sickling. Ascorbic acid stimulation of the hexose shunt pathway was inhibited by NH_2, but methylene blue stimulation remained unaffected. ^{14}C-HN_2 remains bound to red cells in vivo, and the disappearance of radioactivity is similar to that found with ^{14}C-DFP (diisopropylfluorophosphate). Oxygen affinity of both HN_2 and Nor-HN_2 treated human red cells remains virtually the same as that found in control samples. It is concluded that Nor-HN_2 may be a suitable agent for an extracorporeal therapy, and that each mustard needs to be evaluated individually for its antisickling effects and its suitability for extracorporeal use. (auth)

11914 USE OF RADIOACTIVE MICROSPHERES FOR STUDIES OF TUBAL OVUM TRANSPORT. Pauerstein, C. J.; Hodgson, B. J.; Young, R. J.; Chatkoff, M. L.; Eddy, C. A. (Univ. of Texas Health Science Center, San Antonio). Am. J. Obstet. Gynecol.; 122: No. 5, 655-662(1 Jul 1975).

Experiments were designed to ascertain the fidelity with which radioactive (^{125}I-labeled) plastic ovum models imitated the time-course of transport of natural ova through the rabbit oviduct. After location of the radioactive microspheres within the intact oviducts, the genital tracts were removed and cleared in benzyl benzoate. Natural ova and ovum surrogates were then visualized in situ. The radioactive microspheres were reasonably good models of transport of natural ova and their sojourn in the oviduct was shortened by progesterone and prolonged by estrogen. Thus they should be useful tools for future studies of ovum transport under various conditions. (auth)

MATERIALS

11915 MECHANICAL PROPERTIES AT HIGH RATES OF STRAIN. Conference Held at Oxford, England, April 2–4, 1974. Conference Series Number 21. New York; American Institute of Physics (1974). 455p. (CONF-740413-). $34.00.

Thirty-four papers are grouped into four chapters dealing with testing techniques and material behavior at high strain rates, material behavior, wave propagation and fracture, response of structures to dynamic loading, and applications. A discussion is also included at the end of each chapter, as is an author index. Separate abstracts were prepared for 7 of the papers. (DLC)

For abstracts of individual papers see: 11494, 12027, and 12095–12099.

11916 ADVANCES IN CHEMICAL PHYSICS. Volume XXVII. Aspects of the Study of Surfaces. Prigogine, I.; Rice, S. A. (eds.). New York; John Wiley and Sons, Inc. (1974). 662p. $32.50.

Results of research on properties of surfaces are reviewed. Information is included on structure and properties of solid surfaces, chemisorption on metals, surface effects in solids, properties of dielectric surfaces, and electronic properties of liquid metal surfaces. (JRD)

Ceramics and Cermets

Refer also to abstracts 11226, 11227, 11247, 11579, 11580, 11582–11584, 11986, 11998, 12021, 12072, 12109, 12253, 13046, 13048, 13053, 13060, 13096–13098, 13123, 13126, 13133, 13148, 13160, 13178, 13190, 13461, and 13636.

11917 (BMFT-FB-T-74-32) CERAMIC-METAL BONDS WITH IMPROVED MECHANICAL AND THERMAL PROPERTIES. Schickfluss-Borges, E. (Bundesministerium fuer Forschung und Technologie, Bonn (F. R. Germany); Zentralstelle fuer Luft- und Raumfahrtdokumentation und -information, Muenchen (F. R. Germany)). Nov 1974. 98p. (In German). INIS.

A comparison of mechanical testing methods showed that the bending test is the most differentiating test giving the same scatter. Several bending apparatus were developed for round and tubular specimens for testing in the temperature range between room temperature and 750°C. The conventional molybdenum manganese-silicate-process was replaced by the development of the cheaper process of soldering directly with metal powder mixtures of Mo, Ni, Co, and Ag. The cost saving reduction of the metallizing temperature by 100 to 230°C was obtained by specially developed bonding phases. (GE)

11918 (BMI-1818) STUDIES OF THE COMPATIBILITY OF URANIUM CARBIDE WITH REFRACTORY METALS. Fackelmann, J. M.; Moak, D. P. (Battelle Columbus Labs., Ohio (USA)). 24 Oct 1967. Contract W-7405-eng-92. 52p. Dep. NTIS $5.75. Declassified 4 Sep 1973.

At temperatures on the order of 1200°C, hyperstoichiometric UC reacts with certain refractory metals to form single-phase layers in the metal while depleting excess carbon from the fuel. The layer(s) are WC with tungsten, Mo_2C with molybdenum, NbC and Nb_2C with niobium, and TaC and Ta_2C with tantalum. With tungsten–26 wt % rhenium, a two-phase layer consisting of sigma particles in W_2C forms. At temperatures on the order of 1600°C, the reaction layers that form are UWC_2 and W_2C, $UMoC_2$ and Mo_2C, NbC and Nb_2C, TaC and Ta_2C, and UWC_2 and (W_2C + sigma). The rate of growth of these layers can be represented as a parabolic function of reaction temperature. The rates of layer growth are higher in molybdenum and tungsten–26 wt % rhenium, lower in tungsten and tantalum, and intermediate in niobium. The minimum temperature for liquid formation between stoichiometric UC and tungsten, tungsten–26 wt % rhenium, and molybdenum are defined by ternary peritectic reaction isotherms occurring at 2100 to 2150°C, 1850 to 1900°C, and 1800 to 1900°C, respectively. Niobium and tantalum can reduce stoichiometric UC to form liquid uranium at temperatures of 1132°C or greater. Niobium can also reduce hyperstoichiometric UC to form liquid uranium at temperatures greater than 1132°C. (20 figures, 16 tables) (auth)

11919 (CONF-731008-) 4TH INTERNATIONAL SYMPOSIUM ON EXOELECTRON EMISSION AND DOSIMETRY, LIBLICE, CZECHOSLOVAKIA, OCTOBER 1–3, 1973. Bohun, A. (ed.). (Ceskoslovenska Akademie Ved, Prague; Ceskoslovenska Komise pro Atomovou Energii, Prague). 1973. 266p.

Forty-two papers are presented, the largest number dealing with exoelectron emission phenomena in ionic solids, but also covering the physics of exoelectron emission, exoelectron microscopy, and exoelectron dosemeter devices. Abstracts for twenty-two of the papers are included in NSA. Abstracts for two of the papers previously appeared in NSA (28: 27446 and 28: 27714).

For abstracts of individual papers see: 11579–11588, 11920–11924, 12033, and 12191–12196.

11920 (CONF-731008-, pp 85-89) EXOELECTRON EMISSION OF BeO. Euler, M.; Scharmann, A. (Univ., Giessen, Ger.). 1973.

From 4th international symposium on exoelectron emission and dosimetry; Liblice, Czechoslovakia (1 Oct 1973).

In 4th international symposium on exoelectron emission and dosimetry, Liblice, Czechoslovakia, October 1–3, 1973.

Correlations between thermally stimulated exoelectron emission (TSEE) and optically stimulated exoelectron emission (OSEE) indicate that OSEE and one certain glow peak (0-peak) are closely related. A possible stimulation mechanism is proposed. Parallel investigations of thermal and optical decay processes show that the usual kinetic model fails if it is to describe both TSEE and OSEE. (auth)

11921 (CONF-731008-, pp 114-117) ABOUT THE MECHANISM OF TSEE OF INSULATORS AFTER EXCITATION BY ELECTRONS. Glaefeke, H.; Jakowski, N.; Schmidt, M.; Wild, W. (Univ., Rostock, Ger.). 1973.

From 4th international symposium on exoelectron emission and dosimetry; Liblice, Czechoslovakia (1 Oct 1973).

In 4th international symposium on exoelectron emission and dosimetry, Liblice, Czechoslovakia, October 1–3, 1973.

The essential features of the emission mechanism of thermally stimulated exoelectrons excited by electron bombardment are discussed. Excitation by electrons allows the separation of emission from surface states and volume states by variation of the energy of the exciting electrons. This is explained in terms of space charge structures occurring after the electron bombardment. (auth)

11922 (CONF-731008-, pp 118-121) DETERMINATION OF THE PENETRATION DEPTH OF ELECTRONS IN INSULATORS BY THE TSEE-TECHNIQUE. Wild, W.; Schmidt, M.; Glaefeke, H. (Univ., Rostock, Ger.). 1973.

From 4th international symposium on exoelectron emission and dosimetry; Liblice, Czechoslovakia (1 Oct 1973).

In 4th international symposium on exoelectron emission and dosimetry, Liblice, Czechoslovakia, October 1–3, 1973.

A system of two insulating layers with different trap spectra is used to determine the penetration depth of electrons by TSEE-technique (thermally stimulated exoelectron emission). This is based on an emission model assuming that a certain space charge structure is due for the emission process. Applications of TSEE based on the knowledge of the penetration depth of electrons are mentioned. (auth)

11923 (CONF-731008-, pp 122-125) CORRELATION BETWEEN SHORT RANGE ORDER DEFECTS AND ELECTRON TRAP LEVEL SPECTRA IN AMORPHOUS SiO_2 LAYERS OBTAINED BY TSEE TECHNIQUE. Schmidt, M.; Glaefeke, H. (Univ., Rostock, Ger.). 1973.

From 4th international symposium on exoelectron emission and dosimetry; Liblice, Czechoslovakia (1 Oct 1973).

In 4th international symposium on exoelectron emission and dosimetry, Liblice, Czechoslovakia, October 1–3, 1973.

The physical nature of the energy level causing 160°C peak in TSEE (thermally stimulated exoelectron emission) glow curves of SiO_2 layers was investigated. Experimental evidence was found that intrinsic defects, especially trivalent silicon or unsaturated oxygen cause the 160°C peak. (auth)

11924 (CONF-731008-, pp 145-153) PHYSICO-CHEMICAL NATURE OF EXOELECTRON EMISSION. Krylova, I. V. (Moscow State Univ.). 1973.

From 4th international symposium on exoelectron emission and dosimetry; Liblice, Czechoslovakia (1 Oct 1973).

In 4th international symposium on exoelectron emission and dosimetry, Liblice, Czechoslovakia, October 1–3, 1973.

Exoelectron emission from film surface layers at low temperatures was produced by adsorption, and the thermally stimulated emission from various materials is compared for the same conditions of excitation and detection. The emission was studied with chemical, radiational and mechanical methods of excitation. A mechanism is proposed to explain the emission from metals, semiconductors and dielectrics, based on a generalized theory of physicochemical conversions in the sorption layers. (auth)

11925 (GA-A-13310) PREIRRADIATION DESCRIPTION OF FUEL MATERIALS BRANCH SAMPLES CONTAINED IN CAP-

SULES HB-1, HB-3, AND HB-5. Sims, J. R. Jr. (General Atomic Co., San Diego, Calif. (USA)). 1 Feb 1975. Contract AT(04-3)-167. 38p. Dep. NTIS $4.00.

Prototype high-temperature gas-cooled reactor (HTGR) fuel particles have been prepared for irradiation in a series of test capsules (HB-1, HB-3, and HB-5) in the General Electric Test Reactor (GETR). These samples will be used for out-of-pile thermal stability experiments. The unbonded fuel particles will be irradiated in the E-7 position of the GETR to an expected thermal fluence of approximately 2.4×10^{21} n/cm^2 and a fast fluence of approximately 5.0×10^{21} n/cm^2 (E greater than 0.18 MeV/sub GETR/) at a maximum design fuel temperature of 700°C. The estimated burnup is 63 percent FIMA (fissions per initial metal atom) for the fully enriched fissile particles and 0.9 percent FIMA for the fertile particles. The samples were characterized in some cases by density separation or seive sizing, depending on the objectives of future post-irradiation tests. The following particle types were prepared: (1) VSM UC_2 (TRISO), (2) sintered GSP UC_2 (TRISO), (3) WAR U.C/sub x/.O/sub y/ (TRISO), (4) $(Th,U)C_2$ (TRISO), (5) $(Th,U)O_2$ (TRISO and BISO), and (6) ThO_2 (BISO). (auth)

11926 (GEAP-14036) OXYGEN REDISTRIBUTION IN $(U,Pu)O_{2-x}$ FUELS. Evans, S. K.; Aitken, E. A. (General Electric Co., Sunnyvale, Calif. (USA). Breeder Reactor Dept.). Jan 1975. Contract AT(04-3)-893. 34p. AT.

Experimental data which characterize the oxygen transport in mixed oxide fuel subjected to a temperature gradient are described. The results are analyzed in a manner which lend themselves to integration with analyses of irradiated fuel behavior. Use of these data and associated analyses make possible an understanding of irradiated fuel behavior which is based on stoichiometry-dependent parameters. Such analyses will result in better predictions of fuel thermal, chemical, and mechanical behavior. Since the original experiment, a considerable number of other experiments have been carried out to further elucidate the mechanisms involved in oxygen transport phenomena in mixed oxide fuels under the influence of a temperature gradient. The study has included systematic variations in oxygen to metal ratio, plutonium concentration, and time. In addition, the effects of cesium vapor, pellet interfaces along the gradient, and radial versus axial temperature gradients have been determined. Results of these experiments are presented in a discussion concerning their applicability to fuel irradiation. A computer model has been developed to calculate stoichiometry profiles to be expected in irradiated fuel in terms of the important parameters. (auth)

11927 (KFK-2098) SUPERCONDUCTING THORIUM COMPOUNDS UNDER HYDROSTATIC PRESSURE. Dietrich, M. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Experimentelle Kernphysik; Karlsruhe Univ. (TH) (F. R. Germany). Fakultaet fuer Physik). Nov 1974. 43p. (In German). INIS.

Pressure experiments on superconducting thorium compounds have been made up to 28 kbar. The transition temperature was determined by the change in susceptibility, the pickup coil being located within the fluid pressure medium. For thorium hydride Th_4H_{15} and thorium deuteride Th_4D_{15} with T_c's of about 7.6°K, the increase in T_c with pressure was +42 mK/kbar, whereas a separate phase of Th_4H_{15} with the same lattice constant and a T_c of 8.6°K had an increase of +53 mK/kbar. The carbonitrides of thorium show some similarities with refractory materials; such an analogy between thorium hydride and the hydrides of the other transition metals is absent. The superconducting properties of the investigated compounds are explained by additional scattering of the conduction electrons at the light nonmetal elements. (GE)

11928 γ Zr-HYDRIDE PRECIPITATE IN IRRADIATED MASSIVE DELTA Zr-HYDRIDE. Warren, M. R. (Danish Atomic Energy Commission, Risoe, Research Establishment); Bhattacharya, D. K. (Bhabha Atomic Research Centre, Bombay (India). Metallurgy Div.). J. Nucl. Mater.; 56: No. 1, 121-123(Apr 1975).

During examination of a Zircaloy-2-clad fuel pin which had been part of a test fuel assembly in a boiling water reactor, several regions of severe internal hydriding were noticed in the upper-plenum end of the pin. Examination of similar fuel pins has shown that hydride of this type is caused by moisture from the UO_2 fuel. This letter briefly describes the metallographic observations, the results of X-ray diffraction studies and the conclusions which were drawn concerning these particular hydrided regions. (auth)

11929 IRRADIATION OF U_3Si-BASED COMPOUNDS IN THE HIGH-VOLTAGE ELECTRON MISCROSCOPE. Hastings, I. J. (Atomic Energy of Canada Ltd., Chalk River, Ontario). J. Nucl. Mater.; 56: No. 1, 76-80(Apr 1975).

U_3Si and U-3.5 wt% Si-1.5 wt% Al were irradiated in a high-voltage electron microscope (HVEM) at 500-1180 keV and 300-660 K. The creation of "black spot" damage and removal of deformation twins are observed. Defects about 10 nm diameter averaging 4×10^{21} m^{-3} were seen only in samples pre-injected with 10^{-5} atomic fraction argon and are tentatively identified as voids. The atomic displacement rate during HVEM irradiation of U_3Si-based compounds is about two orders of magnitude higher than that for fuel at power reactor ratings. It is inferred that displacement of silicon, and possible uranium, atoms in U_3Si-based compounds occurred in the HVEM at accelerating voltages in the range 700-1180 keV. (auth)

11930 STUDY BY COMPRESSION AT HIGH TEMPERATURES OF THE PLASTIC DEFORMATION OF POLYCRYSTALLINE URANIUM DIOXIDE. Guerin, Y. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Etudes des Combustibles a Base de Plutonium). J. Nucl. Mater.; 56: No. 1, 61-75(Apr 1975). (In French).

The compression of stoichiometric, sintered polycrystalline UO_2 was studied as a function of strain rate ϵ (7×10^{-4} min $< \epsilon < 7 \times 10^{-2}$/min), and temperature T (600 < T < 1700°C). The brittle-to-ductile transition temperature is about 1000°C and the characteristics of the fracture at 600 and 800°C were studied by fractography. In the plastic deformation range, two types of behavior were observed. At low stress ($5 < \sigma < 10$ kg/mm^2), the dependence of strain rate with flow stress σ is $\epsilon = (cte/T)\sigma^{4.5}$ $\exp-(\Delta H/RT)_2$ with $\Delta H \approx 96$ kcal/mol. (The deformation is probably controlled by dislocation climb.) At high stress ($\sigma > 10$ kg/mm^2), the deformation is heterogeneous and one observes a compression yield point, the magnitude of which decreases with increasing temperature. In this range, the analysis of the activation parameters has not allowed the establishment of a very satisfactory correlation with any of the available deformation schemes. (auth)

11931 ELECTRICAL CONDUCTION IN UO_{2+x}. Lee, H. M. (Northwestern Univ., Evanston, Ill. (USA). Dept. of Materials Science). J. Nucl. Mater.; 56: No. 1, 81-84(Apr 1975).

The temperature dependence of electrical conductivity in UO_{2+x} was measured in the temperature range 800-1340 K. It is suggested that an electrical current is carried by positive holes in the 2p band of oxygen, produced by the transfer of electrons to the vacant 5f band U^{+5} ions associated with defect complexes. (auth)

11932 EVAPORATION OF ZIRCONIUM CARBIDE AT HIGH TEMPERATURES IN VACUUM. Zotov, Yu. P.; Kotel'nikov, R. B. Izv. Akad. Nauk SSSR, Metal.; No. 2, 57-61(1975). (In Russian).

A study was made of the evaporation rate of zirconium carbide in the temperature interval from 2770 to 3100°K in vacuum as a function of carbon content. A decrease in the carbon content of zirconium carbide leads to an increase in the evaporation rate of the material. A congruently evaporating composition was found in the Zr-C system. The vapor pressure of zirconium over the carbide of congruent composition is calculated over the temperature interval from 2770 to 3100°K. (SJR)

11933 THERMAL MECHANISM OF THE SWITCHING EFFECT IN OXIDIZED VANADIUM. Tallerchik, B. A.; Terukov, E. I.; Chudnovskii, F. A. (Ioffe Inst. of Physics and Tech., Leningrad). Inzh.-Fiz. Zh.; 28: No. 2, 257-262(Feb 1975). (In Russian).

Switching elements of vanadium dioxide VO_2 are of particular interest in microelectronics. At a temperature of 70°C this material undergoes a phase transition from a semiconductor state (below 70°C) to a metallic state (above 70°C) which is accompanied by a sharp drop in resistance by 5 orders of magnitude. In these switching elements the joule power can heat the sample only to the temperature of the phase transition. The model describing this effect is called a "critical temperature" model. Below room temperature a "thermistor" model explains the behavior of the switching voltage as a function of temperature. The switching effects observed on vanadium foil oxidized in air at 480°C are explained by the action of these two mechanisms. The switching properties of oxidized vanadium foil can be explained by the presence of VO_2 in the oxidized layer, as confirmed by data of x ray structural analysis and electrical measurements. (SJR)

11934 ULTRA-FAST QUENCHING OF MOLTEN REFRACTORY OXIDES. Application to Glass Preparation in Alumina and Gallia Based Systems. Coutures, J.; Sibieude, F.; Rouanet, A.; Foex, M.; Revcolevschi, A.; Collongues, R. (Centre National de la Recherche Scientifique, 66 - Montlouis (France). Lab. des Ultra-Refractaires; Ecole Nationale Superieure de Chemie, 75 - Paris (France)). Rev. Int. Hautes Temp. Refract.; 11: No. 4, 263-268(Oct 1974). (In French).

Two devices making possible splat-cooling of refractory oxides from temperatures above 2,000 C in air are presented. Experiments were carried out in the systems $Ln_2O_3-Al_2O_3$(Ln = La, Nd, Gd, Ho, Er, Yb, Lu, Y) and $Ln_2O_3-Ga_2O_3$ (Ln=La,Gd,Er) in which glasses were obtained. The evolution of these glasses with temperature was studied. (FR)

11935 HIGH TEMPERATURE X-RAY STUDY OF THE Zr-O-C SYSTEM THERMODYNAMICAL EQUILIBRIUM CONDITIONS AND IN VACUUM. Quensanga, A.; Plaloux, A.; Dode, M. (Paris-11 Univ., 91 - Orsay (France). Lab. de Chimie Thermodynamique). Rev. Int. Hautes Temp Refract.; 11: No. 4, 289-294(Oct 1974). (In French).

High temperature X-ray diffraction was used for the study of the phases appearing between 850 and 2,200 C when reducing zirconia by carbon. The two allotropical transformations: αZrO_2(monoclinic)$\rightarrow\beta ZrO_2$(quadratic) at 1196 C; and βZrO_2 (quadratic)$\rightarrow\gamma$ ZrO_2(cubic) at 2000 C are successively observed. The second transition temperature is about 350 C lower than the value generally admitted. This was attributed to a deviation from stoichiometry of β ZrO_2 in a very reducing atmosphere. At every temperature, the lattice parameter of ZrC coexisting with only free carbon in vacuum, is higher than the parameter of ZrC of the monovariant equilibrium ($ZrC-ZrO_2-C-CO$) (ZrC plateau). Inversely in the presence of only zirconia and always in vacuum the parameter of ZrC is smaller than the parameter of the ZrC plateau. It seems that in the first case, the cubic zirconium carbide lost oxygen, this one being substituted by carbon, while in the second case there is a more important substitution of carbon by oxygen in the ZrC lattice. (FR)

11936 STUDY OF INTERACTIONS BETWEEN NITROGEN AND MOLTEN ALUMINA OR ZIRCONIA. Traverse, J. P.; Granier, B.; Foex, M.; Pichoir, F. (Centre National de la Recherche Scientifique, 66 - Montlouis (France). Lab. des Ultra-Refractaires; Office National d'Etudes et de Recherches Aerospatiales (ONERA), 92 - Chatillon (France)) Rev. Int. Hautes Temp. Refract.; 11: No. 4, 295-312(Oct 1974). (In French).

The reactivity of molten alumina and zirconia with nitrogen under pressure from 1 to 125 atmospheres was established in the absence of reducing agents. The reaction is enhanced by decreasing the partial pressure of oxygen and also by increasing the pressure of nitrogen. By the reaction of nitrogen with molten alumina in these conditions over a long period, delta oxynitride is formed at low content. With zirconia more intense effects are observed: zirconium nitride ZrN and a new oxynitride C with cubic fluorite structure are obtained. Certain hypotheses are proposed about the phase diagrams in the vicinity of pure oxides and the nature of interactions between nitrogen and the molten oxide. (FR)

11937 VARIATIONS AT HIGH TEMPERATURE OF THE MIXED IONIC AND ELECTRONIC CONDUCTION, OF THE RARE EARTH SESQUIOXIDES AS A FUNCTION OF OXYGEN PRESSURE. Wilbert, Y.; Dherbomez, N.; Breuil, H. (Amiens Univ., 80 (France). Lab. de Chimie Generale). C. R., Ser. C.; 280: No. 7, 465-467(17 Feb 1975). (In French).

The electrical characteristics of the mixed semi-conducting rare earth sesquioxides are determined from the isothermal variations of the electrical resistance as a function of oxygen pressure. (FR)

11938 ACTION OF WATER VAPOR ON NUCLEAR GRAPHITE. Hydrogenated Product Study by Radioactive Tracer. Chenion, J.; Lang, F. M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service des Elements Combustibles et des Materiaux de Reacteurs a Gaz). Bull. Soc. Chim. Fr.; No. 1, 62-64(Jan 1975). (In French).

The reaction of water vapor with nuclear graphite was studied at 200, 400, and 800 C. First, the release of the hydrogenated products was investigated up to 900 C. It is shown that a large quantity of the water adsorbed by the solid is transformed, this quantity increasing with the reaction temperature. Furthermore, the release of the hydrogenated products was carried out between room temperature and 1100 C, and followed by a total combustion of the sample. It is shown that only a small part of the hydrogen atoms (produced in the reaction of water vapor with graphite) is released in the temperature range 700 to 1100 C. Most of hydrogen is very strongly retained either on the porous sites accessible to dry air (80%) or on the microporous sites (20%). An account of the hydrogenated products was carried out during the desorption of the graphite sample up to 1100 C and by burning. It was compared with the quantities which have reacted at the different temperatures. (FR)

11939 SYNTHESIS OF RESULTS PRESENTED AT THE INTERNATIONAL COLLOQUIUM ON STRESS-CORROSION, (UNIEUX-FIRMINY, JUNE 73). Results Concerning Stainless Steels. Hochmann, J. (Societe Creusot-Loire, 42 - Unieux (France)). Metaux (Corros.-Ind.); 49: No. 591, 385-388(Nov 1974). (In French).

The main points raised at the colloquium on the subject of stainless steels are reviewed. On the theoretical side, topics included the role of surface layers formed in chlorinated solutions, the action of hydrogen, and the electrochemical aspect of stress corrosion. For the section on metallurgical factors, topics were the influence of impurities in stainless steels, the role of sulphides in corrosion of Ni-Cr alloys under intergranular stress, ferritic steels, pure ferritic stainless steels of very low carbon content, and austeno-ferritic steels. (FR)

11940 NEGATIVE CHARGE STORAGE IN THERMAL SiO_2 UNDER ELECTRON IRRADIATION. Sarrabayrouse, G.; Buxo, J. (Centre National de la Recherche Scientifique, 31 - Toulouse (France). Lab. d'Automatique et d'Analyse des Systemes). Compt. Rend., Ser. A, B; 280: No. 4, 69-71(27 Jan 1975). (In French).

Positive charges are generally stored in the oxide of M.O.S. devices after an electron irradiation. The results presented here show that under certain conditions involving the metallic electrode thickness, the energy of the impinging electrons and the sign of the gate bias applied during irradiation, negative charges are trapped in the oxide after irradiation. The influence of the electron beam energy and of the electric field are particularly emphasized. These results can be interpreted by the fact that at an heterojunction the emissivity of the two materials present are different. (FR)

11941 VARIATIONS OF THE IONIC TRANSPORT NUMBER IN Sm_2O_3, Gd_2O_3 AND Dy_2O_3. Wilbert, Y.; Breuil, H.; Dherbomez, N. (Amiens Univ., 80 (France)). C. R., Ser. C.; 280: No. 6, 373-375(10 Feb 1975). (In French).

In the p type conduction zone, the ionic transport number, determined from the isothermal variations of the electrical resistance of oxides as a function of oxygen pressure, agrees with that calculated from the direct measures of the e.m.f. (FR)

11942 EFFECT OF MILLING ON THE SINTERING OF A WC + 6% Co POWDER. Bengtsson, B. (Univ. of Tech., Goteborg); Johannesson, T.; Lindau, L. Planseeber. Pulvermet.; 22: No. 4, 285-291(Dec 1974).

The effect of ball-milling on the sintering behavior during production-like conditions of a WC-6% Co powder has been investigated using dilatometer and electron microscope experiments. The results indicate that the beneficial effect of ball-milling on the sintering rate is not solely due to the reduced grain size, but also to a finer dispersion of binder metal. (auth)

11943 OPTICAL ABSORPTION OF DEFECTS IN V_2O_5 SINGLE CRYSTALS: V_2O_5 DOPED WITH Ti, Mo, AND Cu. Clauws, P.; Vennik, J. (Rijksuniversiteit, Ghent). Phys. Status Solidi B.; 69: No. 2, 491-500(1 Jun 1975).

The absorption spectra in the range from 0.3 to 2.1 eV of V_2O_5 single crystals doped with Ti, Mo, and Cu are presented. Besides bands due to impurities, an enhanced absorption from oxygen vacancies is observed in Ti-doped samples. Models of the various defect centers involved are discussed, and it is shown that the absorption bands can be attributed to centers involving V^{4+} and an impurity. The model of Ballhausen and Gray for vanadyl complexes is used as a working model for the defects. Two weak bands are assigned to ligand field transitions of V^{4+}. The more intense bands are assigned to charge transfer transitions into the orbitals of the neighboring vanadium ions or the impurities. (auth)

11944 PHOTOLUMINESCENCE OF SINGLE CRYSTALS OF $Zn_xCd_{1-x}S$ IRRADIATED WITH FAST NEUTRONS. Kodzhespurov, F. F.; Andrianov, A. A. Zh. Prikl. Spektrosk.; 22: No. 3, 442-445(Mar 1975). (In Russian).

Studies were made of the photoluminescence, emission spectra of self-activated, single crystals of $Zn_xCd_{1-x}S$ which were grown from a melt under inert gas pressure and were irradiated at various, fast-neutron doses from 3×10^{12} to 5×10^{17} neutrons/cm^2. In the interval of 400 to 100 nm, six fluorescence bands stand out, of which three bands coincide with those described earlier for nonirradiated samples. The change in fluorescence intensity of a given band depends on the nature of the emitting center responsible for the band, on the initial concentration in the nonirradiated sample, and on the ratio of components in the solid solution. (SJR)

11945 STUDY OF ELECTRON CAPTURE CENTERS IN IRRADIATED QUARTZ BY EPR AND LUMINESCENCE. Solntsev, V. P.; Lysakov, V. S. Zh. Prikl. Spektrosk.; 22: No. 3, 450-452 (Mar 1975). (In Russian).

In quartz irradiated with gamma rays and electrons a mutual relation was established between EPR centers and bands of thermostimulated and x ray-stimulated luminescence in the interval of 3.2 to 4.5 eV. Models of the centers are proposed

on the basis of an analysis of the EPR spectra, and their relation with lattice defects is also analyzed. It is shown that the emission in the region of 3.2 to 3.8 eV is related to recombination of a free hole with a localized electron (radical of the type of SiO_4^{3-} stabilized near various defects), while the emission in the region of 4 to 4.5 eV is related to recombination of a free hole with a localized electron radical $Si_2O_7^{5-}/H_1OH_2$ stabilized near an internodal oxygen and two nonequivalent protons. (SJR)

11946 EPR INVESTIGATIONS ON THE HOLE CENTERS IN $CaWO_4$ AT T = 4.2 K. Biederbick, R.; Born, G.; Hofstaetter, A.; Scharmann, A. (Justus-Liebig Univ., Giessen, Ger.). Phys. Status Solidi B.; 69: No. 1, 55-62(1 May 1975).

EPR investigations at T = 4.2°K show the principal g-values of the radiation induced hole centers in $CaWO_4$ being different from those obtained at temperatures ≥ 78°K, whereas the principal directions of the g-tensor remain nearly unchanged. The g-tensor at T = 4.2°K is explained by a model in which the hole is assumed in an oxygen p_π-orbital, including some admixtures from other orbitals of the WO_4 tetrahedron. In this model, combined with a weak bonding between two neighbored WO_4 tetrahedra, the observed hyperfine interaction of the hole with two inequivalent ^{183}W nuclei can be understood too. The transition to the results at higher temperatures is possible by a faster exchange of the hole between the two WO_4 complexes. (auth)

11947 INTERSTITIAL ORDERING IN DILUTE NIOBIUM NITROGEN ALLOYS. Jung, P.; Schober, T. (Kernforschungsanlage, Juelich, Ger.). Phys. Status Solidi A.; 29: No. 1, K93-K94 (16 May 1975).

A transitional dilute ordered phase of the Nb–N system, appearing between the supersaturated α-niobium phase and the transition to the α-phase plus Nb_2N, was detected. Decarburized and UHV degassed Nb foils were doped with N from the gas phase, quenched, and examined with transmission electron microscopy. After annealing at 330 C for 30 minutes, the sample showed very faint superlattice reflections appearing at identical positions in reciprocal space which were previously observed for the Ta–N and V–N systems. (PMA)

11948 KINETICS OF THE EARLY-STAGE GAS POROSITY DEVELOPMENT CAUSED BY BUBBLE COALESCENCE. Mikhlin, E. Ya.; Chkuaseli, V. F. (Inst. of Physics and Power Engineering, Obninsk, USSR). Phys. Status Solidi A.; 29: No. 1, 331-337 (16 May 1975).

As a function of time, bubble size distributions are calculated taking into account nonideal gas behavior in small bubbles and the dependence of the surface diffusion coefficient on surface curvature. Comparison with available experimental results at the early stages of bubble development in uranium dioxide and aluminium reveals a better agreement with the calculations carried out, assuming that the motion of small bubbles in uranium dioxide is caused by surface diffusion and in aluminium by volume diffusion. (auth)

11949 RANGE OF HOMOGENEITY OF VO_2 AND THE INFLUENCE OF THE COMPOSITION ON THE PHYSICAL PROPERTIES. II. The Change of the Physical Properties in the Range of Homogeneity. Brueckner, W.; Moldenhauer, W.; Wich, H.; Wolf, E.; Oppermann, H.; Gerlach, U.; Reichelt, W. (Central Inst. for Solid State Physics and Material Research, Dresden). Phys. Status Solidi A.; 29: No. 1, 63-70(16 May 1975).

The electrical resistivity (semiconductor–metal transition), the thermoelectric power, and the magnetic susceptibility of well-characterized VO_2 monocrystals and powdered samples in the range of homogeneity were measured. The physical properties gave no hint of an extension of the range of homogeneity towards oxygen excess. An oxygen deficit ($VO_{1.994}$) strongly influences the semiconductive properties of VO_2 below the phase transition temperature, but hardly influences the metallic properties above the transition temperature. This behavior may be explained by the formation of vanadium interstitial atoms and a rise in the concentration of mobile electrons connected with it. These results explain discrepancies in the data of the physical properties in literature, and show how the properties of VO_2 can be purposefully changed. (auth)

11950 OPTICAL AND ELECTRICAL PROPERTIES OF DOPED In_2O_3 FILMS. Koestlin, H.; Jost, R.; Lems, W. (Philips Forschungslaboratorium G.m.b.H., Aachen). Phys. Status Solidi A.; 29: No. 1, 87-93(16 May 1975).

Sn doped In_2O_3 films are electrically conductive and transparent in the visible range of the spectrum. Films with a plasma wavelength in the 1 μm region were prepared by spraying a solution of $InCl_3$ and $SnCl_4$ onto a heated substrate. The free electron concentration is observed to increase with the Sn content up to a maximum. A tentative explanation of this maximum is presented. The optical constants of the films are compared with theoretical values obtained from electrical data. At long wavelengths the experimental results are in good agreement with the classical dispersion formula of a free electron gas. At wavelengths in the region of and shorter than the plasma wavelength the damping is found to be smaller than that predicted by classical theory. Films with a rough surface, typical dimensions of the roughness being 10^{-5} cm, exhibit an additional surface plasmon absorption. In conjunction with the shift of the plasma edge to shorter wavelengths with increasing free electron density, a shift of the UV-absorption edge to shorter wavelengths is observed, corresponding to the rise of the Fermi level within a parabolic conduction band. Consequences for the valence band structure are discussed. (auth)

11951 ROLE OF RADIATION DAMAGE IN THE CRYSTALLIZATION KINETICS OF THIN AMORPHOUS DIELECTRIC LAYERS. Pavlov, P. V.; Genkina, N. A.; Shitova, E. V.; Tetalbaum, D. I. (Physico-Technical Research Inst., Gorky, USSR). Phys. Status Solidi A.; 29: No. 1, 303-307(16 May 1975).

A method for the calculation of vacancy concentrations, induced by ion implantation, is presented which is based on the change of the parameters in the curve of radial distribution of the atomic density (CRD) after irradiation. It is shown that the lowering of the crystallization temperature of amorphous films after ion bombardment can be explained with a decrease of the self-diffusion activation energy by the change of interatomic distances. Using the change of parameters in CRD with irradiation the degree of the lowering of the crystallization temperature is calculated. Agreement with experimental values for SiO_2 is obtained. (auth)

11952 INVESTIGATION OF THE CROSS SECTION OF THE SYSTEM $Eu_2O_3-La_2O_3-Ta_2O_5$ WITH A Ta_2O_5 CONTENT OF 75 MOLE %. Ustimovich, A. B.; Pinaeva, M. M.; Kuznetsova, V. V. (Inst. of Physics, Minsk). Inorg. Mater.; 10: No. 11, 1708-1710 (Nov 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 11, 1992-1994(Nov 1974).

In the quasibinary system $Eu_xLa_{1-x}Ta_3O_9$, investigated at 1250°C, using x-ray-structural, luminescence, and electron-microscopic analysis, the existence of a solid solution based on an orthorhombic structural type was established throughout the range of values of x. The change in the unit-cell parameters and the displacement of the bands in the luminescence spectra take place nonmonotonically with the changes in the composition of the system; anomalies are observed near x = 0.01, 0.15, and 0.35. The morphological changes of the specimens correspond to structural changes. (auth)

11953 CHANGES IN QUARTZ IRRADIATED WITH NEUTRONS. Krivokoneva, G. K.; Solntseva, L. S.; Pergamenshchik, B. K.; Korenevskii, V. V. (Inst. of Mineral Resources, Moscow). Inorg. Mater.; 10: No. 11, 1714-1719(Nov 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 11, 1998-2005(Nov 1974).

When quartz is irradiated with fluxes of the order of 10^{19}-10^{20} neutrons/cm^2, the structural changes due to the same flux of neutrons with energies above 10 keV are fairly accurately reproduced in different independent experiments. In some respects, the action of neutrons on the structure of quartz resembles the action of heat: the lattice expands, the $\alpha \rightarrow \beta$ transition occurs, and the quartz becomes "fused" (goes into a state resembling quartz glass). These changes occur against a background of gradual destruction of the structural periodicity. During annealing at 900-1000°C, the original crystal structure is recovered only if the irradiated quartz has preserved the structure of α-quartz, albeit in an imperfect state. If irradiation has converted the quartz to β-quartz with strongly disturbed periodicity, annealing renders it amorphous, and the amorphous quartz is perfectly similar to quartz glass. The critical flux of neutrons with E > 10 keV, above which the quartz loses the capacity to recover its original structure, is about $0.9 \cdot 10^{20}$ neutrons/cm^2. (auth)

11954 ELECTRICAL RESISTANCE OF STABILIZED ZIRCONIUM DIOXIDE AT HIGH TEMPERATURES. Alekseenko, L. S.; Koifman, G. Yu.; Posokhova, E. D.; Shakhtin, D. M. Inorg. Mater.; 10: No. 11, 1720-1722(Nov 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 11, 2006-2008(Nov 1974).

The electrical resistance of ZrO_2 stabilized with Y_2O_3 or CaO was measured in the range 800-2000°C. The medium was found to have no effect on the results of measurements. (auth)

11955 REACTION OF LITHIUM BORATES WITH VANADIUM PENTOXIDE. Kulieva, S. A.; Rza-Zalde, P. F.; Ganf, K. L.; Luzhnaya, N. P. (Inst. of Inorganic and Physical Chemistry, Baku). Inorg. Mater.; 10: No. 11, 1727-1729(Nov 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 11, 2013-2016(Nov 1974).

Using differential thermal analysis, x-ray-phase analysis, and

infrared spectroscopy, an investigation was made of the reactions of Li borates with V_2O_5 in the cross sections $LiO \cdot B_2O_3 - V_2O_5$, $Li_2O \cdot 2B_2O_3 - V_2O_5$, and $Li_2O \cdot 3B_2O_3 - V_2O_5$ in a wide concentration range (0-100 mole % V_2O_5). The formation of a new complex borate of the composition $2Li_2O \cdot V_2O_5 \cdot 2B_2O_3$ was established, and its physicochemical characteristics are given. (auth)

11956 LUMINESCENT PROPERTIES OF INTENTIONALLY NONACTIVATED YTTRIUM ORTHOVANADATE. Maiorova, N. N.; Minaeva, N. V.; Prikazchikova, A. P.; Glagoleva, A. A.; Boev, E. I. Inorg. Mater.; 10: No. 11, 1730-1732(Nov 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 11, 2017-2019(Nov 1974).

With an increase in the purity of the initial compounds, the luminescence spectrum of YVO_4 is simplified and the luminescence intensity increases. It is suggested that the quality of oxides of Y and V for synthesis of YVO_4 phosphors should be characterized from the results of measurements of the luminescence intensity and the luminescence spectra of self-activated specimens. (auth)

11957 MAGNETIC PROPERTIES OF CdO. Strakhov, L. P.; Rashidkhanov, K.; Korolev, V. V. (Leningrad State Univ.). Inorg. Mater.; 10: No. 11, 1794-1795(Nov 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 11, 2091-2092(Nov 1974).

The magnetic susceptibility and its temperature dependence was investigated for CdO powder in the range 20-650 C. The value obtained was $-(35.7 \pm 0.6) \cdot 10^{-6}$, which did not vary over the experimental temperature range. (PMA)

11958 POSITRON ANNIHILATION IN SOME TRANSITION METAL OXIDES. Cizek, A. (Inst. of Physical Metallurgy, Brno); Wolf, M. Phys. Status Solidi B.; 69: No. 2, K105-K109 (1 Jun 1975).

The results of angular correlation measurements of positron annihilation in oxides of titanium, vanadium, copper, niobium, and molybdenum are reported. The data support theoretical and other experimental results which show that positron annihilation in oxides is quite different than in simple metals. It is concluded that the usual interpretation of the annihilation curve is not possible for transitional metal oxides. (PMA)

11959 COINCIDENCE TWIST BOUNDARIES ON CdO CRYSTALS. Schober, T.; Fischer, K. (Kernforschungsanlage, Juelich, Ger.). Phys. Status Solidi A.; 29: No. 1, K15-K20 (16 May 1975).

Evidence is presented for the occurrence of (111) coincidence boundaries in vapor phase grown CdO crystals. Metallography of the bicrystals showed grain boundaries mainly perpendicular to the ⟨111⟩ rotation axis, indicating twist boundaries. The misorientations between the crystals were derived from Laue back reflection patterns. (PMA)

11960 PARAMETRIC INVESTIGATION OF THE GLOW DISCHARGE TECHNIQUE FOR SINTERING UO_2. Thomas, G.; Freim, J. (Univ. of Oklahoma, Norman). Trans. Am. Nucl. Soc.; 21: 182-183(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11961 HIGH BURNUP INSTRUMENTED IRRADIATION OF BORON CARBIDE (YY02 EXPERIMENT). Pitner, A. L. (Westinghouse Hanford Co., Richland, WA). Trans. Am. Nucl. Soc.; 21: 183-184(Jun 1975).

From transaction of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11962 FABRICATION OF FFTF FUEL PINS AT BABCOCK AND WILCOX. Ross, W. J. (Babcock and Wilcox Co., Apollo, PA). Trans. Am. Nucl. Soc.; 21: 248-250(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11963 EFFECT OF GRAIN SIZE ON THE SWELLING AND GAS RELEASE PROPERTIES OF UO_2 DURING IRRADIATION. Turnbull, J. A. (Central Electricity Generating Board, Berkeley, Eng.). pp 48.1-48.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

Uranium dioxide specimens of two different grain sizes have been irradiated at 1750°C up to .4% FIMA and measurements made of fission gas release and dimensional changes. The results show a significant reduction of both these effects with increasing grain size. Also at swelling values around 10% the major contribution to swelling was due to grain edge tunnels which were extensively interlinked to the free surface. The consequence of this is discussed regarding models for both gas release and swelling. (auth)

11964 FISSION GAS RE-SOLUTION MECHANISMS AND KINETICS. Marlowe, M. O.; Kaznoff, A. I. (General Electric Co., Pleasanton, CA). pp 79.1-79.8 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

The size distributions of fission gas bubbles in UO_2 after post-irradiation annealing are log-normal. Anomalous reports of the gas content of bubbles may be the result of ignoring the effect of curvature on the surface energy of UO_2. The change in bubble size on re-irradiation is consistent with a mechanism with decreased effectiveness for bubbles larger than ~200Å dia. The re-solution rate probability per unit time was observed to be $2.7 \times 10^{-4} s^{-1}$. (auth)

11965 PRODUCTION OF Al_2O3 AND Nb_2O_5 POWDERS IN THE PLASMA OF A SUPERHIGH FREQUENCY DISCHARGE. Grushetskii, S. V.; Kiryushin, V. P.; Krylova, I. A.; Silina, A. A.; Yas'ko, O. I. (Inst. of Heat and Mass Exchange, Minsk). Vestsi Akad. Navuk Belarus. SSR, Ser. Fiz.-Energ. Navuk; No. 1, 110-114 (1975). (In Russian).

The possibility of production of aluminum or niobium oxide under conditions of the low-temperature high-frequency discharge plasma is discussed. Some process flow diagrams and methods of powder production are analyzed. (auth)

11966 STUDIES OF HYDROLYZABLE CARBIDES. VI. Neodymium Dicarbide, its preparation and hydrolysis. Bozek, V. (Inst. of Chemical Tech., Prague); Hajek, B.; Mostecky, J. Sb. Vys. Sk. Chem.-Technol. Praze, Rada B.; 14: 27-44(1972). (In Czech).

The reduction of neodymium trioxide by carbon at low pressure was observed with the object of preparing neodymium dicarbide. The carbidic product formed was hydrolyzed, the gaseous decay products were investigated applying mass, infrared, and ultraviolet spectrometry and gas chromatography. It was found that the gaseous products were formed by a mixture of hydrogen and linear hydrocarbons of the C_3, C_4, C_6, and C_{10} series whose proportion changes as a result of continuing cold hydrogenation and polymeration, catalyzes by the solid phase formed during the decomposition of neodymium dicarbide. The ratio of hydrogen and carbon in gaseous products has, however, a constant value of approximately 1.5. 8f, 8t. (Nucl. Sci. Abstr. Czech.)

11967 STUDY OF THE STRUCTURE, ELECTRICAL CONDUCTIVITY, AND ITS CHARACTER IN THE $ZrO_2 - Sc_2O_3 - Fe_2O_3$ SYSTEM. Neuimin, A. D.; Karavaev, Yu. N.; Pal'guev, S. F. Tr. Inst. Elektrokhim., Ural. Nauch. Tsentr. Akad. Nauk SSSR; No. 21, 132-141(1974). (In Russian).

Studies were made of the sinterability, structure; and electrical conductivity of samples of varying composition in the $ZrO_2 - Sc_2O_3 - Fe_2O_3$ system. It is shown that the introduction of 1 to 2 mol % of iron oxides into the composition of a ceramic mass substantially decreases the temperature for the formation of a cubic solid solution based on zirconium dioxide, and the calcination temperature. Three-component solid solutions are formed in this system, and the solubility of iron oxide in the zirconium dioxide depends on the content of scandium oxide in the mixture. The minimum content of scandium oxide assuring the appearance of a cubic solid solution of $ZrO_2 + Sc_2O_3 + Fe_2O_3$ is 6 to 7 mol % Sc_2O_3. The highest solubility of iron oxide in this case is about 5 to 6 mol %. In the presence of a small amount of iron oxide there is no transition from a cubic structure with distortions to a distortion-free, cubic structure, which is observed for a two-component solid solution of $ZrO_2 - Sc_2O_3$ in the temperature interval of 550 to 900°C. It was established that an increase in content of iron oxide to 3 to 4 mol % in the cut having a content of 10 mol % of the sum $Sc_2O_3 + Fe_2O_3$ has no substantial effect on the magnitude of the ion electrical conductivity of the sample, and in the cut having a content of 15 mol % of this sum, this increase leads to an increase of the ionic electrical conductivity. The electrical conductivity remains purely ionic as long as the content of scandium oxide is not decreased below 3 to 4 mol %, and the monoclinic phase of zirconium dioxide does not predominate in the structure of the samples. (SJR)

11968 PLASMA SPUTTERING OF ZIRCONIUM DIOXIDE STABILIZED BY YTTRIUM OXIDE AND BY ADDITIVES OF Fe_2O_3 AND Bi_2O_3. Neuimin, A. D.; Gil'derman, V. K.; Pal'guev, S. F. Tr. Inst. Elektrokhim., Ural. Nauch. Tsentr. Akad. Nauk SSSR; No. 21, 126-131(1974). (In Russian).

Studies were made of the porosity, electrical conductivity, and structure of plasma-sputtered layers of zirconium dioxide stabilized with yttrium oxide and additives of Fe_2O_3 and Bi_2O_3. It is shown that the Fe_2O_3 additive leads to some densification

of the covering at high plasma-torch power, while the Bi_2O_3 additive leads to an increase in porosity. On sputtering with a nitrogen-argon and an argon–helium plasma with a powder having the Fe_2O_3 additive, a line of an additional phase, which vanishes after annealing at 1350°C, appears in the sputtered layer. During sputtering and annealing at 1350°C, the Fe_2O_3 additive evaporates less than the Bi_2O_3 additive. The electrical conductivity of sputtered samples in the temperature interval from 400 to 1000°C differ only slightly from the electrical conductivity of samples obtained by the ceramic method. (SJR)

11969 OXYGEN PENETRABILITY OF CERAMICS BASED ON ZrO_2. Gil'derman, V. K.; Neuimin, A. D.; Pal'guev, S. F. Tr. Inst. Elktrokhim., Ural. Nauch. Tsentr. Akad. Nauk SSSR; No. 21, 118-125(1974). (In Russian).

Oxygen penetrability (P) was experimentally determined for ceramics having compositions of 0.9 ZrO_2 + 0.1 Y_2O_3 and 0.89 ZrO_2 + 0.008 Y_2O_3 + 0.03 Al_2O_3 in the temperature region of 900 to 1240°C and pressures of 0.01 to 1 atm. The penetrability constants in $cm^2/s\text{-}atm^{0.25}$ were P = 1.55 exp (–43,100 (± 300)/RT) for the 0.9 ZrO_2 + 0.1 Y_2O_3 ceramic, and P = 1.52 exp (–42,700 (±500)/RT) for the ceramic having a composition of 0.89 ZrO_2 + 0.08 Y_2O_3 + 0.03 Al_2O_3. The oxygen penetrability is proportional to the oxygen pressure raised to the one-fourth power. The oxygen diffusion coefficient does not depend on the partial pressure of oxygen. (SJR)

11970 NATURE OF THE CONDUCTIVITY OF ZrO_2–Sc_2O_3 SAMPLES CALCINED IN AIR. Volchenkova, Z. S. Tr. Inst. Elektrokhim., Ural. Nauch. Tsentr. Akad. Nauk SSSR; No. 21, 108-117(1974). (In Russian).

Measurements were made of the ion transfer number by the emf method, and a p-type of electron conductivity was established for ZrO_2–Sc_2O_3 samples calcined in air (1550°C) in the composition interval of zero to 100 mol % Sc_2O_3 at temperatures of 500 to 1000°C and an oxygen pressure of ~1 atm. For the sample containing 12.5 mol % Sc_2O_3 the transfer numbers were obtained by two methods which gave identical values for the oxygen-ion conductivity. Calculations are made of the temperature dependencies of the electrical conductivity components and their temperature coefficients. Isotherms were constructed. These data are in good agreement with the phase relations of the system. The results are discussed in the light of the theory of ionic crystals with defects. (SJR)

11971 COMPOSITION AND STRUCTURE OF CATHODE DEPOSITS ON ELECTROLYZING MOLTEN MIXTURES OF Li_2WO_4–WO_3 AND K_2WO_4–WO_3. Tarasova, K. P.; Nazarov, V. A.; Esina, N. O. Tr. Inst. Elektrokhim., Ural. Nauch. Tsentr. Akad. Nauk SSSR; No. 21, 61-65(1974). (In Russian).

On the basis of electrolysis experiments on melts of Li_2WO_4–WO_3 and K_2WO_4–WO_3, diagrams were constructed of the dependence of the composition of cathode products as a function of the electrolysis conditions (concentration, temperature), from which it was possible to delimit the regions of deposition of tungsten bronzes, metallic tungsten and tungsten dioxide. It is shown that the melt composition and temperature have the greatest effect on the phase composition of the bronzes. The effect of current density is smaller. (SJR)

11972 CONTRIBUTIONS TO THE CHEMISTRY OF RARE ELEMENTS. LXV. Formation of Mixed Crystals in the System of Sm_2O_3–Y_2O_3, Sm_2OE–Yb_2O_3, and Sm_2O_3–DY_2O_3. Hajek, B.; Kalalova, E.; Stompfova, H. (Inst. of Chemical Tech., Prague). Sb. Vys. Sk. Chem.-Technol. Praze, Rada B.; 14: 21-26(1972). (In Czech).

Mixed crystals in the systems Sm_2O_3–Y_2O_3, Sm_2O_3–Dy_2O_3 and Sm_2O_3–Yb_2O_3 were prepared and studied applying the Debye-Scherrer x-ray diffraction method. The presence of Y^{3+}, Dy^{3+} and Yb^{3+} stabilizes the cubic lattice of Sm_2O_3. Sm_2O_3 and Y_2O_3 form a series of mixed crystals with continuously varying concentration, while Sm_2O_3 and Dy_2O_3 form mixed crystals only in the range of 0 to 60 molar % of Sm_2O_3. The formation of mixed crystals of Sm_2O_3 with Yb_2O_3 were studied only in the range of 0 to 75 molar % of Sm_2O_3; in this range a continuous series of mixed crystals was ascertained. 6f, 1t. (Nucl. Sci. Abstr. Czech)

11973 PHOTOCONDUCTIVITY ON EUROPIUM OXIDE SINGLE CRYSTALS AND THIN FILMS. Llinares, C.; Gouskov, L.; Duchemin, C.; Bordure, G. (Univ., Montpellier, France). J. Phys. Chem. Solids; 36: No. 6, 567-573(Jun 1975).

Results of photoconductivity measurements on four EuO samples are given. Low-frequency photoconductivity versus temperature (10°K < T < 300°K) and magnetic field H is investigated for two wavelengths: 6600 Å and 9000Å. The photoconductivity kinetic is also described; it is characterized by a distribution in decay times. Temperature, magnetic field, and carrier concentration have small effects on this kinetic. Quenching effect is obtained by adding a continuous illumination (λ_2) to the weak modulated light (λ_1). The kinetic is strongly affected by quenching and becomes more simple. Quenching effect is maximum for the wavelength associated to the $4f^7 - 4f^6$ 5d, transition. In contrast to the Penney–Kasuya (I.B.M. Research RC; 3093 (1970); Solid State Comm.; 8:1547 (1970); J. of Appl. Phys.; 42:4 (1971)) model another one is proposed in which the conduction of equilibrium carriers as photo-excited carriers takes place in a broad band. The variation of low-frequency photoconductivity versus temperature is attributed to the mobility variation. This variation agrees well with the model of mobility controlled by spin-disorder. The photoconductivity kinetic is interpreted by a three levels recombination model: the conduction band, the 4f levels and a distribution of trap levels. The lack of variation of photoconductivity decay in the range of metal–semiconductor transition is discussed. (auth)

11974 METALLOGRAPHIC EXAMINATION OF TD-NICKEL BASE ALLOYS. Kane, R. D.; Petrovic, J. J.; Ebert, L. J. (Case Western Reserve Univ., Cleveland). Metall. Trans., A; 6: No. 6, 1296-1301(Jun 1975).

To observe the microstructures in TD-nickel-chromium (TD–NiCr), standard Ni-etch (92 percent HCl, 3 percent HNO_3, 5 percent H_2SO_4), chromic acid and oxalic acid solutions were found unsatisfactory chemical etches. However, an electrochemical etch consisting of six parts ethanol, one part H_2SO_4 and twenty-one parts H_2O delineated the grains when the etching voltage was five volts. The efficiency of this etch decreased dramatically with the increasing grain size. It was later found that a thermal-oxidation etch produced better detail of grain boundaries and had excellent etching behavior over the entire range of grain sizes of TD-NiCr produced (0.001 mm to 0.5 mm). The etching procedure was that of placing a polished specimen of TD–NiCr in a preheated furnace at 600°C for times of 5 to 10 min. A selective oxidation of the grain boundaries occurred. For grain sizes greater than about 0.05 mm, some heat tinting was noted which aided in grain observations. No microstructural changes were found as a result of this thermal etching technique. (auth)

11975 SYSTEM CaO–ThO_2–ZrO_2. Roeder, E. W. F.; Wilson, H. J. C. (Philips Forschungslaboratorium, Aachen). J. Am. Ceram. Soc.; 58: No. 5-6, 161-163(1975).

The present investigation did not confirm the conclusion of Ruff et al. [Z. Anorg. Allg. Chem. 207, 3, 308 (1932)] that certain compositions within the system CaO–ThO_2–ZrO_2 might solidify in the vitreous state. Although many ZrO_2-rich samples were translucent after they were melted in an induction plasma torch, x-ray diffraction results indicated a crystalline structure of the fluorite type. When samples were annealed at 1400°C, the metastable phase decomposed, and translucency was lost. A section of the system at 1600°C is presented, together with a preliminary description of a pyrochlore-type compound with the approximate composition $2CaO \cdot 2ThO_2 \cdot 5ZrO_2$. (auth)

11976 PRECIPITATION IN PARTIALLY STABILIZED ZIRCONIA. Bansal, G. K. (Battelle Columbus Labs., OH). J. Am. Ceram. Soc.; 58: No. 5-6, 235-238(1975).

Transmission electron microscopy was used to study the substructure of partially stabilized ZrO_2 (PSZ) samples, i.e., 2-phase systems containing both cubic and monoclinic modifications of zirconia, after various heat treatments. Monoclinic ZrO_2 exists as (1) isolated grains within the polycrystalline aggregate (a grain-boundary phase) and (2) small plate-like particles within cubic grains. These intragranular precipitates are believed to contribute to the useful properties of PSZ via a form of precipitation hardening. These precipitates initially form as tetragonal ZrO_2, with a habit plane parallel to the brace 100 brace matrix planes. The orientation relations between the tetragonal precipitates and the cubic matrix are brace 100 brace/sub matrix/ 2 parallel brace 100 brace /sub precipitate/ or (001)/sub precipitate/ and broken bracket 100 broken bracket/sub matrix/ 2 parallel broken bracket 100 broken bracket/sub precipitate/ or [001]/sub precipitate/. (auth)

11977 CHEMICAL VAPOR DEPOSITION OF HAFNIUM CARBIDE. Hertz, D.; Spitz, J.; Besson, J. (CEN, Grenoble, France). High Temp.–High Pressures; 6: No. 4, 423-433(1974). (In French).

From 8th Plansee seminar; Reutte, Austria (27 May 1974).

A study is reported of the deposition of hafnium carbide from the vapor phase by the action of methane on hafnium tetrachloride in the presence of hydrogen. The influence of the temperature and the composition of the vapor phase (H_2/CH_4 and $CH_4/HfCl_4$ ratios) on the rate of deposition and on the nature and quality of the coatings (metallic hafnium, hafnium + carbide, single-phase carbide, carbide + free carbon) was determined. With the ex-

perimental setup employed, stoichiometric hafnium carbide could be deposited at temperatures from 1200 to 1500°C and with $CH_4/HfCl_4$ ratio as different as 0.25, 1, and 4.5. A model of the reaction mechanism is postulated which accounts for the experimental results. (auth)

11978 IMPROVED SINTERING PROCESS FOR PRODUCTION OF URANIUM DIOXIDE PELLETS. Adams, R. B. (to Australian Atomic Energy Commission). Australian Patent 25,651/71. 24 Aug 1972. Filed date 9 Apr 1970. 7p.

A process is described for the production of pellets of stoichiometric uranium dioxide. The process comprises sintering cold-pressed pellets of non-stoichiometric uranium dioxide having a O:U atomic ratio greater than 2 by heating the pellets in a flowing atmosphere of nitrogen containing from 5,000 to 30,000 ppM of water and from 1 to 10% by volume of hydrogen at a temperature of at least 900°C, and thereafter allowing the pellets to cool in a cooling atmosphere containing from 1 to 5% by volume of hydrogen. The total throughput of hydrogen during sintering being not less than the theoretical amount required to reduce the non-stoichiometric uranium dioxide to stoichiometric uranium dioxide. (AT)

11979 APPLICATIONS AND PROPERTIES OF SINTERED ZIRCONIA. I. Mechanical and Thermal Properties. Sturhahn, H. H.; Thamerus, G. (Feldmuehle A. G., Plochingen (F. R. Germany)); Dawihl, W. (Universitaet des Saarlandes, Saarbruecken (F. R. Germany)). Ber. Dtsch. Keram. Ges.; 52: No. 3, 59-62(Mar 1975). (In German).

A compilation of data is presented on two types of newly developed sintered zirconia. The peculiarities of sintered zirconia are compared with other materials. Some of the mechanical properties, e.g., hardness, impact resistance, and notch sensitivity, afford considerable advantages as compared with other oxides. (GE)

11980 SPIN POLARIZED PHOTOEMISSION FROM La-DOPED EuO IN THE VACUUM ULTRAVIOLET. Meier, F.; Eib, W.; Pierce, D. T. (Eidgenoessische Technische Hochnische Hachschule, Zurich). Solid State Commun.; 16: No. 9, 1089-1091 (1 May 1975).

The spin polarization of photoelectrons emitted from La-doped EuO was measured as a function of light energy up to $h\nu = 11$ eV, together with the quantum yield. The spectrum of spin polarization can be understood in terms of the energy level diagram of bulk EuO. (auth)

11981 INTERSTITIAL DEFECTS IN CUBIC-STABILIZED ZIRCONIA. Forwood, C. T.; Allpress, J. G. (Commonwealth Scientific and Industrial Research Organization, Port Melbourne, Australia). Cryst. Lattice Defects.; 5: No. 3-4, 223-233(1974).

Dislocation loops were found in crystals of cubic-stabilized zirconia–yttria and zirconia–lime solid solutions, prepared by argon-arc melting followed by annealing in air at 900 to 1300°C. These defects are identified by electron microscope contrast experiments as interstitial edge dislocation loops on {110}, with Burgers vectors of the type $\frac{1}{2}\langle 110\rangle$. They are only found when the initial melting is accompanied by slight reduction and the subsequent annealing is oxidative. It is proposed that interstitial cations are produced in the arc-melted crystals to accomodate some of the oxygen deficiency, and that during annealing under oxidizing conditions, these cations cluster with oxygen to form interstitial loops of oxide. (auth)

11982 ELECTRON MICROSCOPIC STUDY OF PHASE TRANSITION PHENOMENA IN PURE AND Cr-DOPED V_2O_3 SINGLE CRYSTALS. Launay, J. C. (CNRS, Talence, France); Pouchard, M.; Ayroles, R.; Jouffrey, B. Mater. Res. Bull.; 10: No. 6, 559-564(Jun 1975). (In French).

An investigation by electron microscopy confirms the low temperature transition in single crystal of V_2O_3 and $V_{2-x}Cr_xO_3$ ($x = 0.048$). The twin planes were identified in the corundun structure as $(1\ 1\ \bar{2}\ 0)_M$. An explanation is proposed. (auth)

11983 Na_2SO_4 INDUCED ATTACK OF Ni–20Cr–2ThO_2. Davis, H. H.; Graham, H. C.; Uhlig, G. F. (Aerospace Research Labs., Wright Patterson AFB, OH). pp 1014-1020 of Proceedings of the Fifth International Congress on Metallic Corrosion, Houston, TX; National Association of Corrosion Engineers (1974).

From 5th international congress on metallic corrosion meeting; Tokyo, Japan (21 May 1972). See CONF-720523-.

Microstructures of products from Ni–20Cr–2ThO_2 reactions with Na_2SO_4 were studied. It was found that a transient stage of accelerated attack occurs, corresponding to the growth of an NiO scale. Internal chromium sulfide particles are observed to be present in the alloy. Steady state kinetics result from the formation of a Cr_2O_3 inner layer which controls the growth of additional oxide. (auth)

11984 FABRICATION OF THIN URANIUM DIOXIDE FILMS FOR NEUTRON FLUX MEASUREMENTS. Feintuch, K. D.; Meem, J. L. (Univ. of Virginia, Charlottesville). Nucl. Technol.; 26: No 2, 232-236(Jun 1975).

A method for fabricating dense thin films of enriched uranium dioxides was developed which produces foils that are not affected by self-shielding. The similarity in enrichment between enriched fuel and the foils assured that the measured activities are representative of the fission-producing flux in a reactor. The high density and small size of the films allows the foils to be located accurately within the core and to achieve adequate activation at low power. (auth)

Metals and Alloys

11985 REACTOR CONTAINMENT STEELS AND RULES FOR THEIR SPECIFICATION. (International Atomic Energy Agency, Vienna). pp 31-51 of Neutron Irradiation Embrittlement of Reactor Pressure Vessel Steels. Steele, L. E. Vienna; International Atomic Energy Agency (1975).

See STI/DOC–10/163.

Steels used in world-wide reactors and in U.S. reactors are reviewed. Specifications, codes, and requirements are discussed. Ferritic steels, used at first, gave way to low alloy steels (Mn–Mo–Ni grades for water reactors). Recommendations for the future are given. (DLC)

11986 MATERIALS FOR THE MINING INDUSTRY. Symposium Held at Vail, Colorado, July 30–31, 1974. New York; Climax Molybdenum Company (1974). 225p. (CONF-740753-).

Development of high-strength materials for mining equipment is reviewed. Twenty papers are included on hard facing alloys, materials for percussion drilling, materials for surface mining equipment, hauling equipment, and materials for grinding equipment. (JRD)

Corrosion and Erosion

Refer also to abstracts 11140, 13178, 13184, and 13443.

11987 (DP–1162) INTERACTIONS OF THULIUM OXIDE WITH CONTAINER METALS. Smith, P. K.; Keski, J. R. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). Nov 1968. Contract AT(07-2)-1. 20p. Dep. NTIS $4.00.

Declassified 4 Sep 1973.

The properties of Tm_2O_3 make it an attractive fuel form for ^{170}Tm heat sources. To establish specifications for a reactor target to produce ^{170}Tm in a form suitable for direct use in isotopic heat sources after irradiation, possible interactions between Tm_2O_3 and candidate container metals were evaluated at temperatures up to 2000°C. Reaction between Tm_2O_3 and aluminum, the cladding material for target assemblies during irradiation, was observed only above 590°C, considerably higher than projected temperatures of irradiation. After 1000 hours at 1000°C, no significant reaction was observed between Tm_2O_3 and tungsten, tantalum, molybdenum, Inconel 600, or Haynes 25. Short-term tests of Tm_2O_3 in sealed tantalum capsules were made to verify the thermodynamic predictions of the compatibility of Tm_2O_3 with refractory metals. Reaction of Tm_2O_3 with Ta to form $TmTaO_4$ occurred in unsealed capsules, which allowed escape of the product Tm (or TmO) gas. Reaction between silica in the Tm_2O_3 and Ta to form Ta_5Si demonstrated the need for control of impurities in the target Tm_2O_3. (auth)

11988 (DP-MS-75-10) INHIBITION OF NITRATE STRESS CORROSION CRACKING OF MILD STEEL IN NUCLEAR PROCESS WASTES. Donovan, J. A. (Du Pont de Nemours (E.I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). 1975. Contract AT(07-2)-1. 16p. (CONF-750624-7). Dep. NTIS $4.00.

From American Nuclear Society meeting; New Orleans, Louisiana, USA (8 Jun 1975).

The concentration of hydroxide and nitrite ions necessary to prevent crack growth in A-285-B steel exposed to waste solutions was determined by the systematic testing of solutions within the ranges of hydroxide, nitrate, and nitrite concentrations found in waste tanks. The relative susceptibility to SCC was assumed to be dependent on the concentrations of nitrate, nitrite, and hydroxyl ions; the other components were assumed to have little effect on cracking. All of the tests were done at 97°C, with specimens loaded initially to an effective stress intensity of 45 ksi root in. Both the temperature of exposure and the initial stress intensity create conditions more severe than would normally be found in the waste tanks. All specimens were exposed for a minimum of 1000 hours. Results showed that the aggressiveness of the solutions increased with increasing nitrate ion concentration. For example, cracks grew in 5M NO_3^- + 0.3M NO_2^-, but not in 1.5M NO_3^- + 0.3M NO_2^-. Also, the solutions causing crack growth

within the range of compositions found in the waste tank were concentrated in the high nitrate–low nitrite, hydroxyl ion region. Most of the results were obtained with solutions containing 5M NO_3^- and various amounts of nitrite and hydroxyl ion concentrations. (JRD)

11989 (KFK-2033) INCOLOY ALLOY 800: STEAM CORROSION EXPERIMENTS UNDER HEAT TRANSFER AND ISOTHERMAL STEAM CORROSION TESTING OF VARIOUS SUPERHEAT MATERIALS IN A HIGH PRESSURE LOOP. Final Report HKW. Leistikow, S.; von Berg, H.; Jennert, D.; Erbacher, F.; Vasarhelyi, J. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung; Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Reaktorbauelemente; Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Schneller Brueter). Dec 1974. 28p. (In German). INIS.

For steam corrosion testing of superheat materials under high heat fluxes a high pressure steam loop was constructed and successfully operated during two years. Indirect electrically heated incoloy alloy 800 thin wall tubing was tested at 450 to 700°C, 150 atm, 200 W/cm², 16 to 50 m/s, while various superheat materials were isothermally exposed at 600°C, 150 atm, 3.5 m/s as coupons or tube sections. The corrosion experiments under heat transfer showed that–under the applied conditions and in comparison with isothermally exposed tube sections–no corrosion increasing effect was exerted by loop exposure. Oxidation kinetics were governed by a parabolic rate law. Only in case of long-time application pessimistic assumptions (as stress-induced spalling) can justify the extrapolation of increased metal losses. Isothermal testing of various cold deformed superheat materials proved high corrosion resistance under the applied dynamic loop conditions and long-time exposures. (GE)

11990 (SAND-75-8243) CORROSION AND PROTECTION OF URANIUM ALLOY PENETRATORS. Weirick, L. J.; Johnson, H. R.; Dini, J. W. (Sandia Labs., Livermore, Calif. (USA)). Jun 1975. Contract AT(29-1)-789. 96p. Dep. NTIS $8.00.

Penetrators made from either a U–3/4 percent Ti alloy or a U–3/4 percent Mo–3/4 percent Zr–3/4 percent Nb–1/2 percent Ti alloy ("Quad") corrode mildly in moist air, significantly in moist nitrogen, and severely in salt fog. Adequate protection was provided in moist air and nitrogen by coating with electroplated nickel, electroplated nickel and zinc with a chromate finish, and galvanized zinc with a chromate finish. In salt fog, electroplated nickel offered only temporary protection whereas galvanized zinc and electroplated nickel-zinc provided long-lasting protection. The resistance of uncoated penetrators was affected variously by dissimilar metal couplings. Aluminum protected the Quad alloy and adversely affected the U–3/4 percent Ti alloy, whereas steel enhanced localized corrosion in both. (auth)

11991 (UCID-16793) OXIDATION OF THORIUM IN OXYGEN, HUMID AIR, AND HUMID NITROGEN. McKenzie, D. R.; Colmenares, C. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 19 May 1975. Contract W-7405-eng-48. 8p. (CONF-740621-4). Dep. NTIS $4.00.

From JOWOG 12 meeting; Aldermaston, UK (17 Jun 1974).

The oxidation of two different grades of thorium, each with two different surface treatments, by water vapor at a pressure of 13.33 kPa has been studied in both air and nitrogen between 353 and 415°K. The dependence of the oxidation rates on the partial pressure of water vapor at 415°K was also investigated for these two grades of thorium. The oxidation of the lower-purity, arc-melted thorium was studied in 6.66 kPa oxygen between 373 and 433°K. The dependence of the oxidation rate on the partial pressure of oxygen was determined at 415°K for the arc-melted thorium. (auth)

11992 (UCID-16798) CORRELATION OF LONG STORAGE BEHAVIOR OF THORIUM-EPOXY COMPOSITES WITH LABORATORY DATA ON THE CORROSION OF THORIUM. Colmenares, C.; McKenzie, D. R.; Dickie, J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 19 May 1975. Contract W-7405-eng-48. 11p. (CONF-740621-3). Dep. NTIS $4.00.

From JOWOG 12 meeting; Aldermaston, UK (17 Jun 1974).

Large thorium and Mulberry parts were adhesively bonded to polystyrene foam by means of an epoxy. Thorium surfaces were present in two forms: machined or untreated and passivated in an HNO_3–HF solution. Experimental units were stored at temperatures ranging from 32 to 71°C for times greater than six months in order to test the integrity of the metal to foam bond. Two types of measurements were made in the evaluation of test units. Gases were extracted from the unit, measured, and analyzed. In addition, the units were disassembled and the thorium and Mulberry surfaces were examined for separation of the adhesive from the metal surface and for oxidation of the two metals. In cases where separation had occurred between the thorium surface and the adhesive due to oxidation, oxide thickness measurements were performed. Units stored at 71.1°C showed severe corrosion of the machined thorium and moderate corrosion of the passivated thorium. The Mulberry parts had a slight blue color. In both units there was separation between the thorium and the adhesive, which actually lifted a film of ThO_2 from the metal. Other two units which were stored at 48.9 and 60°C respectively, showed a light oxidation of the thorium both machined and passivated. Good adhesion was observed between the thorium and the adhesive. The presence of small amounts of HCl and Cl_2 did not significantly contribute to the oxidation of thorium in these experiments. (JRD)

11993 CORROSION OF STAINLESS STEEL IN THE PRESENCE OF CAESIUM. Antill, J. E.; Peakall, K. A.; Smart, E. F. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). J. Nucl. Mater.; 56: No. 1, 47-60(Apr 1975).

Cesium-enhanced oxidation of austenitic stainless steel was studied in the context of the attack of the internal surfaces of fuel cans, arising with the release of oxygen and fission products from oxide fuel. Cesium vapor at 10^{-2}–1 atm enhanced the attack under conditions which produced a solid reaction product. The enhanced attack took the form of surface oxidation, intergranular oxidation, visible by optical metallography, and deep cesium penetration to produce local cesium concentrations within the range 10 ppb–100 ppm. The effects of cesium were not dependent upon the formation of appreciable amounts of mixed compounds of cesium and chromium, slight cesium contaminations being sufficient. They required $\overline{\Delta G}_{O_2}$ to exceed a certain minimum threshold value established as ≤ −100 kcal/mol at 700°C. The enhanced attack did not occur at <550-600°C, whilst the kinetics were fast at >740°C. Cesium pressure was not a significant variable over the range covered. (auth)

11994 REVIEW OF CORROSION AND MASS TRANSPORT IN LIQUID SODIUM AND THE EFFECTS ON THE MECHANICAL PROPERTIES. Fidler, R. S.; Collins, M. J. (Central Electricity Research Labs., Leatherhead, Eng.). At. Energy Rev.; 13: No. 1, 3-50(Mar 1975).

The chemical and metallurgical effects of exposing candidate fast reactor materials to liquid sodium are described. The thermodynamic principles that lead to corrosion and mass transport in liquid sodium are briefly discussed and the factors that interact to affect the kinetics of these processes are reviewed. Experimental observations of corrosion and mass transport are presented and effects on mechanical properties are related to metallurgical changes due to the environment. It is shown that interstitial element transport is the major cause of strength or ductility changes in materials exposed to liquid sodium. The conclusion is reached that mass transport in liquid sodium is a complex phenomenon, the mechanisms of which are not fully understood. Until the observed processes can be accurately quantified, large design safety factors will continue to be necessary. (auth)

11995 AQUEOUS CORROSION OF STEELS AND NICKEL-BASE ALLOYS IN A NUCLEAR CONTEXT. Antill, J. E. (UKAEA, Harwell, Eng.). Int. Metall. Rev.; 19: 252-254(Dec 1974).

The interest in aqueous corrosion of iron-base and nickel-base alloys has increased considerably since the development of BWRs and PWRs. Attack may be in the form of generalized corrosion, localized pitting, or stress corrosion cracking. A brief review is given of the published work on the stress corrosion cracking of ferritic steels, austenitic stainless steels, and high-nickel alloys such as Fe–32Ni–20Cr or Ni–16Cr–7Fe. Major gaps are found to exist in data required for the design and operation of plant, such as boilers, and in an understanding of the factors governing behavior. More information is required for ferritic steel under corrosion-fatigue conditions and in chloride and caustic solutions. In the case of high-nickel content alloys more data are required on the behavior of alloys 600 and 800 and others of similar compositions. (UK)

11996 INFLUENCE OF SODIUM ENVIRONMENT ON THE UNIAXIAL CREEP-RUPTURE BEHAVIOR OF AISI TYPE 304 STAINLESS STEEL. Natesan, K.; Chopra, O. K. (Argonne National Lab., Idaho Falls, ID). Trans. Am. Nucl. Soc.; 21: 156-157(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11997 HYDROGEN EMBRITTLEMENT OF AUSTENITIC STAINLESS STEELS. Louthan, M. R. Jr.; Rawl, D. E. Jr.; Donovan, J. A.; Holmes, W. G. (E. I. du Pont de Nemours and Co., Aiken, SC). Trans. Am. Nucl. Soc.; 21: 158(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11998 REACTION OF EUROPIA WITH AUSTENITIC STAINLESS STEELS. Wu, P. C. S. (Westinghouse Electric Corp., Madison, PA). Trans. Am. Nucl. Soc.; 21: 184-185(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

11999 INHIBITION OF NITRATE STRESS CORROSION CRACKING OF MILD STEEL IN NUCLEAR PROCESS WASTES. Donovan, J. A. (E. I. du Pont de Nemours and Co., Aiken, SC). Trans. Am. Nucl. Soc.; 21: 266-267(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12000 ELECTROCHEMICAL CORROSION OF MOLYBDENUM IN ALKALI METAL CHLORIDE MELTS. Ozeryanaya, I. N.; Zalazinskii, G. G. Tr. Inst. Elektrokhim., Ural. Nauch. Tsentr. Akad. Nauk SSSR; No. 21, 72-74(1974). (In Russian).

A study was made of the electrochemical corrosion of molybdenum in melts of sodium chloride, potassium chloride, an equimolar mixture of NaCl and KCl, and in CsCl by the method of steady-state potentials under clean conditions with an atmosphere of helium over the melt at 800 to 950°C. It is shown that the rate of electrochemical corrosion is very small, and is on the order of 10^{-3} A/cm^2. The corrosion increases in the series NaCl–KCl–CsCl. A relation is derived for the steady-state potential of molybdenum as a function of temperature and cation radius of the salt medium. The steady-state potential becomes more negative in the series of alkali metal chlorides from sodium to cesium. (SJR)

12001 BEHAVIOR OF STAINLESS STEEL AND ALLOYS DURING THE CONDENSATION OF THE DISSOCIATING COOLANT N_2O_4. Gol'tsev, V. P.; Kamenev, A. Ya.; Fedyushin, E. E. (Inst. of Nuclear Energy, Minsk). Vestsi Akad. Navuk Belarus. SSR, Ser. Fiz.-Energ. Navuk; No. 1, 34-41(1975). (In Russian).

Results of experimental investigations of the behaviour of some steels and alloys in condensing N_2O_4 at 132°C and under 50 atm for 3000 hours are given. The influence of such factors as salt melting at the specimens surface, structure and Mo, Ti, Cr, Ni, Mn, Cu, Si additions on the corrosion of steels and alloys is analysed. (auth)

12002 EFFECTS OF MOLYBDENUM ADDITIONS TO NICKEL–CHROMIUM ALLOYS ON THEIR SULFIDATION PROPERTIES. Young, D. J.; Smeltzer, W. W.; Kirkaldy, J. S. (McMaster Univ., Hamilton, Ont.). Metall. Trans., A; 6: No. 6, 1205-1215(Jun 1975).

The effects of molybdenum additions to gamma-phase Ni–Cr on the reaction of the alloys with H_2/H_2S atmospheres at 700°C has been investigated. The effect is to reduce the rate of internal sulfidation of the alloys, diminish greatly the extent of liquid sulfide formation, and slow the growth rate of external solid sulfide scale. The first two effects are thermodynamic in origin while the last effect is due to favorable doping of Cr_2S_3 and to the formation within a Cr_3S_4 scale of MoS_2 precipitates which partially block outward metal diffusion. (auth)

12003 INTERACTIONS BETWEEN STRUCTURAL MATERIALS AND LIQUID METALS AT ELEVATED TEMPERATURES. Natesan, K. (Argonne National Lab., IL). Metall. Trans., A; 6: No. 6, 1143-1153(Jun 1975).

A number of liquid alkali metals with significantly better thermal and heat-transfer properties are being considered as coolants, heat-transport media and working fluids for use in advanced energy systems. In these applications, the structural materials of the energy system are exposed to a high-temperature liquid-metal environment, which can result in both metallic and nonmetallic element mass transfer and significant microstructural changes with a subsequent degradation of mechanical behavior. The influence of temperature, material composition, and liquid-metal purity (i.e., oxygen, carbon, and nitrogen content) on interaction processes such as embrittlement, compound formation, reduction in strength, and liquid-metal penetration is discussed. The importance of material selection and system operating limits to minimize potential problems in reactor systems is presented. (auth)

12004 TRANSMISSION MICROSCOPY OF THE CORROSION SCALE FORMED ON A STAINLESS STEEL EXPOSED TO LIQUID SODIUM. Madden, P. K.; Fisher, S. B. (Central Electricity Generating Board, Berkeley, Eng.). J. Mater. Sci.; 10: No. 4, 599-607(Apr 1975).

The scale, formed on 304 stainless steel during exposure to sodium for 85 days, was removed electrolytically, examined in transmission in the Hitachi high voltage microscope, and found to consist of hexagonal close packed crystallites, typically 0.3 to 1 μm in diameter. Approximately 90% of the crystallites were of basal (0001) orientation and the others either of (4, $\bar{1}$, $\bar{3}$, 15) or ($\bar{2}$110) orientations. Lattice parameters a = 2.96 Å and c = 13.89 Å were determined by analyzing electron diffraction patterns derived from the scale. Confirmatory evidence was obtained by examining the scale formed after a shorter exposure of 29 days, in the Philips EM 200 microscope. Previous studies have indicated that the scale may be sodium chromite (with lattice parameters a = 2.96 Å and c = 15.95 Å). Results are in apparent conflict with this suggestion unless a contraction parallel to the c-axis ~13% is assumed. (auth)

12005 PREVENTION OF EMBRITTLEMENT OF METALS. Abel, W. T.; Bailey, D. M. (to Secretary of the Interior). US Patent 3,149,006. 15 Sep 1964. Filed date 31 Jan 1963. 6p.

Embrittlement of a metal such as W, Mo, Ta, or alloy steel in an inert atmosphere (He) at high temperature, may be prevented by adding to the atmosphere small amounts of an oxidizing gas (250 ppM O_2) and also of hydrogen to prevent oxidation. (DLC)

12006 PROCEEDINGS OF THE FIFTH INTERNATIONAL CONGRESS ON METALLIC CORROSION, TOKYO, JAPAN, MAY 21–27, 1972. Houston, TX; National Association of Corrosion Engineers (1974). 1052p. (CONF-720523-).

From 5th international congress on metallic corrosion meeting; Tokyo, Japan (21 May 1972).

Approximately 205 papers are included in the book. A separate abstract was prepared for each of eighteen papers selected for NSA. (JRD)

For abstracts of individual papers see: 11983, 12007–12022, and 12143.

12007 STUDY OF ELECTROCHEMICAL BEHAVIOR OF MOLYBDENUM. Heumann, T.; Klimmeck, M. (Univ., Munster, Ger.). pp 115-118 of Proceedings of the Fifth International Congress on Metallic Corrosion, Houston, TX; National Association of Corrosion Engineers (1974).

From 5th international congress on metallic corrosion meeting; Tokyo, Japan (21 May 1972). See CONF-720523-.

Measurements of Mo oxidation in nonaqueous electrolytes are reported. It was found that by polarizing Mo in ethanol–KOH solutions, curves characteristic of metals which can be passivated are obtained. Calculation results are included to show that it is possible to make a choice from many conceivable dissolution mechanisms. (JRD)

12008 CORROSION CHARACTERISTICS OF InSb ACIDIC SOLUTIONS. Patterson, R. E. (California Inst. of Tech., Pasadena); Nobe, K. pp 119-122 of Proceedings of the Fifth International Congress on Metallic Corrosion, Houston, TX; National Association of Corrosion Engineers (1974).

From 5th international congress on metallic corrosion meeting; Tokyo, Japan (21 May 1972). See CONF-720523-.

The effects of crystallographic orientation and surface structures on anodic and cathodic polarization of InSb were studied. An analysis of resulting data on electrochemical parameters is presented along with discussions of data on corrosion potential as function of pH, and hydrogen evolution vs pH. (JRD)

12009 PASSIVATION OF ALLOYS ON TITANIUM BASE. Tomashov, N. D.; Chernova, G. P.; Ruskol, Yu. S.; Ayuyan, G. A. (Inst. of Physical Chemistry, Moscow). pp 248-252 of Proceedings of the Fifth International Congress on Metallic Corrosion, Houston, TX; National Association of Corrosion Engineers (1974).

From 5th international congress on metallic corrosion meeting; Tokyo, Japan (21 May 1972). See CONF-720523-.

Results of passivation studies on Ti-base alloys show that the inhibition of anodic processes on these alloys is determined not by the total thickness of passive film, but by its barrier layer. The protective properties of the barrier layer increase if the passive film is formed at anodic potentials more positive than +1.4V. They were determined not by chemical stability of barrier layer, but by an inhibition which is produced by this layer for ionic current along the anodic direction. The protective properties are related to character defectiveness and semiconductor properties of the barrier layer. Additions of Al, V, Mo, Zr, and Nb to titanium increase the anodic current in the passive state. Additions of Cr and Mn decrease this current, and Sn does not influence it. The direct electrochemical transition of titanium ions into solution (as TiO^{2+}) is a main anodic process of titanium dissolution and its low alloyed alloys in the passive state. Double phase titanium alloys (after tempering) have a lower corrosion resistance than those in the homogeneous single phase state (after hardening). The less passive phase of double phase alloys dissolves perferentially. The less passive phases are: in the active state, alpha-phase; in transpassive state for Ti–Mo alloys, beta-phase, containing in a high Mo percentage; and for Ti–Cr alloys, gamma-phase, having more chromium. (auth)

12010 TRANSPASSIVITY OF ZIRCONIUM IN PERCHLORIC ACID SOLUTION: AN EXAMPLE OF CO-EXISTENCE OF ACTIVE AND PASSIVE REGIONS. Gohr, H.; Wendler-Kalsch, E.; Behm, B. (Univ., Erlangen-Nurnberg, Erlangen, Ger.). pp 298-301 of

Proceedings of the Fifth International Congress on Metallic Corrosion. Houston, TX; National Association of Corrosion Engineers (1974).

From 5th international congress on metallic corrosion meeting; Tokyo, Japan (21 May 1972). See CONF-720523-.

Electrochemical properties of Zr are examined with emphasis on the mechanisms of transitions between active and passive states in perchloric acid solutions. Discussions are included on the phenomenon of anodic activation, open circuit potentials, and relations of activation potentials with acid concentration. (JRD)

12011 PASSIVATION BEHAVIOR OF Ti6A14V. Buhl, H. (Deutsche Forschungs- and Versuchsanstalt fur Luft- and Raumfahrt e.V., Porz-Wahn, Ger.). pp 302-306 of Proceedings of the Fifth International Congress on Metallic Corrosion. Houston, TX; National Association of Corrosion Engineers (1974).

From 5th international congress on metallic corrosion meeting; Tokyo, Japan (21 May 1972). See CONF-720523-.

Results of studies are presented on repassivation of $TiAl_6V_4$ specimens under stress corrosion after initial fracture of the corrosion film. Data on repassivation behavior of this alloy in aqueous sodium halide and methanol solutions are presented and analyzed. (JRD)

12012 ANODIC OXIDATION OF ZIRCONIUM. Morozumi, T.; Moriya, M. (Hokkaido Univ., Sapporo, JA). pp 322-325 of Proceedings of the Fifth International Congress on Metallic Corrosion. Houston, TX; National Association of Corrosion Engineers (1974).

From 5th international congress on metallic corrosion meeting; Tokyo, Japan (21 May 1972). See CONF-720523-.

The electrochemical evolution of oxygen from passivated Zr surfaces was studied. Several observations of this phenomenon are described and an explanation of the electronic mechanisms of the reaction is given. (JRD)

12013 EFFECT OF THERMOMECHANICAL TREATMENT OF THE STRESS CORROSION CRACKING OF METASTABLE BETA III TITANIUM. Seats, J. H. (Air Force Inst. of Tech., Wright-Patterson AFB, OH); Condit, D. O. pp 474-476 of Proceedings of the Fifth International Congress on Metallic Corrosion. Houston, TX; National Association of Corrosion Engineers (1974).

From 5th international congress on metallic corrosion meeting; Tokyo, Japan (21 May 1972). See CONF-720523-.

Results of studies on the relations of microstructural changes with stress corrosion of Ti-11.5 Mo-6 Zr-4.5 Sn (Beta III) alloys are presented. It was found that this alloy is virtually immune to stress corrosion cracking if no imperfections in the surface are present. Specimens that had not been cold worked showed surface deterioration, but it was not serious enough to cause any marked reduction in yield strengths. The alloy is, however, susceptible to SCC if the surface contains an imperfection such as a fatigue crack where high stresses can concentrate during testing. These high stress levels at the crack tip may cause mechanical destruction of the passivating oxide and allow a higher concentration of chloride ions near the fresh metal surfaces. However, even with precracked specimens, crack propagation is slow as evidenced by no failures within the 720 hour test period. The extreme notch sensitivity of Beta III prevented initiation of fatigue cracks in the sections of the alloy with 20 and 50 percent cold work. More research must be done to test Beta III in this condition. However, on the basis of the research conducted thus far, SCC susceptibility of Beta III titanium alloy appears to be independent of thermomechanical pretreatment. (auth)

12014 ELECTROCHEMICAL INVESTIGATIONS ON TITANIUM AND TITANIUM ALLOYS. Bauer, E.; Nann, E. (Univ., Frankfurt am Main). pp 503-506 of Proceedings of the Fifth International Congress on Metallic Corrosion. Houston, TX; National Association of Corrosion Engineers (1974).

From 5th international congress on metallic corrosion meeting; Tokyo, Japan (21 May 1972). See CONF-720523-.

It is noted that instability of metal surfaces arises from electrodic mechanisms. Surface instability can be propagated to the inside of the metal. Hydrogen atoms cathodically formed may be adsorbed on the metal surface and can react in two ways. They may be desorbed as hydrogen molecules in either a chemical or electrodic reaction and diffuse into the solution, this is a step away from the metal surface. The other possibility is a step into the metal: hydrogen atoms formed at the surface of the metal may diffuse into the metal and form absorbed hydrogen. The first reaction is studied by hydrogen overvoltage measurements, the second by diffusion measurements. Ti, Ti-13V-11Cr-Al13, and Ti-6Al-6V-2Sn specimens were used in the investigations. It is concluded that hydrogen embrittlement is the forerunner of stress corrosion cracking in Ti and its alloys by the formation of titanium hydrides. (JRD)

12015 HIGH TEMPERATURE OXIDATION OF URANIUM ALLOYS. Cathcart, J. V.; Pawel, R. E.; Petersen, G. F. (Oak Ridge National Lab., TN). pp 669-674 of Proceedings of the Fifth National Congress on Metallic Corrosion. Houston, TX; National Association of Corrosion Engineers (1974).

From 5th international congress on metallic corrosion meeting; Tokyo, Japan (21 May 1972). See CONF-720523-.

The high temperature oxidation characteristics of several U alloys containing Nb, Zr, and Mo were studied. In all cases, oxide formation involved the generation of large stresses in the oxide, and the magnitude of these stresses was estimated to be 10^6 psi. Oxidation of these alloys proceeds via anion diffusion, and the stresses arise because of the need to accommodate the volume expansion accompanying the oxidation of U. The existence of these stresses activates several stress relief mechanisms including the plastic deformation of both oxide and metal and a flow of vacancies to the oxide-metal interface. (auth)

12016 TECHNIQUE FOR STUDYING THE RATE CONTROLLING PROCESSES DURING METAL OXIDATION. Cox, B. (Atomic Energy of Canada Ltd., Chalk River, Ont.). pp 682-689 of Proceedings of the Fifth International Congress on Metallic Corrosion. Houston, TX; National Association of Corrosion Engineers (1974).

From 5th international congress on metallic corrosion meeting; Tokyo, Japan (21 May 1972). See CONF-720523-.

Results of oxidation experiments are described involving Nb, Ta, U, Al, and Ni in which conducting, oxidizing fused salts are used as the oxidizing mediums as well as the electric contacts. Hysteresis observed in current-voltage curves could not be eliminated or explained proving a serious limitation in interpretation of oxidation mechanisms in these metals. (JRD)

12017 STRESS GENERATION AND ITS EFFECTS DURING THERMAL AND ANODIC OXIDATION OF ZIRCONIUM. Hammad, F. H. (U.A.R. Atomic Energy Establishment, Cairo); Leach, J. S. L. pp 732-739 of Proceedings of the Fifth International Congress on Metallic Corrosion. Houston, TX; National Association of Corrosion Engineers (1974).

From 5th international congress on metallic corrosion meeting; Tokyo, Japan (21 May 1972). See CONF-720523-.

Results of thermal and anodic oxidation of Zr are presented. It was found that in any situation where an oxidation process leads to a highly stressed oxide film, in interpreting the results of experimental work, it is necessary to ensure that effects arising from these oxide stresses be considered. In the particular case of zirconium where the oxide is formed with a large compressive stress, the forces involved are sufficient to deform the substrate metal where test specimens are very thin, or to fracture the oxide film on thick substrates at low growth rates. This can lead in both thermal and anodic oxidation to marked effects on the oxidation kinetics. (auth)

12018 ELECTROCHEMICAL MEASUREMENTS OF CORROSION PROCESSES IN A BOILING WATER NUCLEAR REACTOR. Cowan, R. L.; Kaxnoff, A. I. (General Electric Co., Pleasanton, CA). pp 874-883 of Proceedings of the Fifth International Congress on Metallic Corrosion. Houston, TX; National Association of Corrosion Engineers (1974).

From 5th international congress on metallic corrosion meeting; Tokyo, Japan (21 May 1972). See CONF-720523-.

The use of electrochemical methods in measurement of in-reactor corrosion of structural materials was studied. Weight loss rates were measured on 304 stainless steel, Inconel 600, and ASTM A106 steel. It is concluded that electrochemical kinetic measurements in high purity water containing small amount of H_2 and O_2 at temperatures over 932°C are not suitable for determining general corrosion rates of reactor structural materials. The kinetics of O_2 reduction and H_2 oxidation obscure the kinetics contribution of metal oxidation. A suitably designed Ag/AgCl electrode can be used to measure potentials on the standard hydrogen scale in high-purity water at temperatures above 932°C. A system has been developed that can be used for electrochemically controlled stress corrosion testing under sustained loads in electrolytes above 932°C. Stress corrosion results developed in this system compare favorably with those obtained by more conventional techniques. (auth)

12019 INVESTIGATION OF STRESS CORROSION CRACKING SUSCEPTIBILITY OF Fe-Ni-Cr ALLOYS IN NUCLEAR REACTOR WATER ENVIRONMENTS. Clarke, W. L.; Gordon, G. M. (General Electric Co., Pleasanton, CA). pp 884-894 of Proceedings of the Fifth International Congress on Metallic Corrosion. Houston, TX; National Association of Corrosion Engineers (1974).

From 5th international congress on metallic corrosion meeting; Tokyo, Japan (21 May 1972). See CONF-720523-.

Investigations were conducted to gain understanding of intergranular stress corrosion cracking (IGSCC) in Inconel 600 and stainless steels. It was found that heavily sensitized AISI 304 stainless steel is susceptible to IGSCC when tested over yield strength in 288°C

water containing dissolved oxygen. A dependence to IGSCC on applied stress is apparent, although it is not clear to what relative extent stress affects the initiation and propagation phases. Dissolved oxygen accelerates IGSCC, particularly at levels above approximately 3 ppM. Other metallurgical parameters, i.e., cold-work, degree of sensitization, surface finish, orientation, cleaning, and compositional heterogeneities, significantly influence IGSCC kinetics. A technique has been developed for measuring SCC propagation rates of susceptible materials in high temperature and pressure environments. Several promising alternate reactor structural alloys have been identified for use in coolant environments where operation in a post weld heat treatment (sensitized) condition is desired. (auth)

12020 CORROSION CONTROL IN CANDU NUCLEAR POWER REACTORS. Lesurf, J. E. (Atomic Energy of Canada, Ltd., Chalk River, Ont.). pp 895-901 of Proceedings of the Fifth International Congress on Metallic Corrosion. Houston, TX; National Association of Corrosion Engineers (1974).

From 5th International congress on metallic corrosion meeting; Tokyo, Japan (21 May 1972). See CONF-720523-.

Corrosion control in CANDU reactors which use pressurized heavy water (PHW) and boiling light water (BLW) coolants is discussed. Discussions are included on pressure tubes, primary water chemistry, fuel sheath oxidation and hydriding, and crud transport. It is noted that corrosion has not been a significant problem in CANDU nuclear power reactors which is a tribute to design, material selection, and chemistry control. This is particularly notable at the Pickering Nuclear Generating Station which will have four CANDU-PHW reactors of 540 MWe each. The net capacity factor for Pickering-I from first full power (May 1971) to March 1972 was 79.5 percent, and for Pickering II (first full power November 1971) to March 1972 was 83.5 percent. Pickering III has just reached full power operation (May 1972) and Pickering IV is still under construction. Gentilly CANDU-BLW reached full power operation in May 1972 after extensive commissioning tests at lower power levels with no major corrosion or chemistry problems appearing. Experience and operating data confirm that the value of careful attention to all aspects of corrosion control and augur well for future CANDU reactors. (auth)

12021 CORROSION AND CORROSION INHIBITION OF STEELS AND REFRACTORY MATERIALS IN HEAVY LIQUID METALS. Banerjee, S. (Atomic Energy of Canada Ltd., Pinawa, Manitoba). pp 902-907 of Proceedings of the Fifth International Congress on Metallic Corrosion. Houston, TX; National Association of Corrosion Engineers (1974).

From 5th international congress on metallic corrosion meeting; Tokyo, Japan (21 May 1972). See CONF-720523-.

Corrosion of Croloy and refractory metals and materials by liquid Pb–55.5 wt percent Bi alloy was studied. Corrosion of Fe- and Ni-free steels was found to depend on dissolution of Fe, and the rate controlling step in rotating disk studies was found to be diffusion through the liquid boundary layer. In loop studies, the situation is more complex because the dissolution rate may depend on the rate at which materials can come out of solution either in the form of oxide or as elemental iron deposited in the colder portions of the circulating systems. In any case, the rate at which iron dissolves in the hot portions is very rapid. Small additions (approximately 10 to 200 mug/g) of Zr to Pb–Bi and Ce to Pb appear to inhibit corrosion remarkably and carbon and low chrome–molybdenum steels are suitable for containing circulating systems. Niobium is corroded slightly in Pb–Bi but not in Pb. Ta and Mo are unattacked by all the heavy liquid metals. Graphite and SiC have pores which are penetrated by the liquid metals with bonding material like Si being leached out. (auth)

12022 AQUEOUS CORROSION OF OXIDIZED STAINLESS STEEL FUEL ELEMENT CANNING MATERIAL. Jones, D. D. G.; Newman, J. F. (Central Electricity Research Labs., Leatherhead, Surrey). pp 908-912 of Proceedings of the Fifth International Congress on Metallic Corrosion. Houston, TX; National Association of Corrosion Engineers (1974).

From 5th international congress on metallic corrosion meeting; Tokyo, Japan (21 May 1972). See CONF-720523-.

Corrosion stainless steel fuel element cans in cooling ponds was investigated. In one series of experiments the fuel elements were discharged from the reactor into the cooling pond filled with demineralized water. In another series of tests the fuel element canning material was immersed in borated solutions. Corrosion data are presented in tables and plots and discussed. (JRD)

Preparation and Fabrication

Refer also to abstracts 11248 and 13177.

12023 (ORNL-tr-2962) TECHNOLOGY OF MELTING AND CASTING URANIUM AND ITS DILUTE ALLOYS. Kaderabek, E.; Sokol, L. (Ustav Jaderneho Vyzkumu, Rez (Czechoslovakia)). May 1968. Translation of UJV–1994. 37p. Dep. NTIS $5.00.

Equipment and techniques used for melting and casting of uranium and its alloys are reviewed. Refractory materials are assessed from the standpoint of their thermodynamic and other physical properties and compatibility with molten uranium. Experimental results and experience in melting and casting of uranium and some dilute alloys are also reported. Particular attention is paid to melting in sintered-alumina crucibles, chemical-homogenity problems, and casting defects. (auth)

12024 EFFECT OF ANNEALING IN ARGON ON THE PROPERTIES OF THE MOLYBDENUM ALLOY TsM-6. Morgunova, N. N.; Timofeeva, A. A.; Fedorova, L. M.; Dushin, Yu. A.; Emel'yanova, L. I. Izv. Akad. Nauk SSSR, Metal.; No. 2, 136-139(1975). (In Russian).

In using molybdenum materials under high-temperature conditions, the composition, structure, and properties vary depending on the degree and kind of impurity in the inert medium. Under conditions of intensive mass transfer, the degree of contamination of material from the outside may be limited by insufficient diffusion mobility of the absorbed element in the alloy and it may not depend on the concentration of impurity in the gas stream. Saturation of the molybdenum material with impurity elements of the inert medium during recrystallization leads to a decrease in plasticity at room temperature and at the operating temperature. (SJR)

12025 THERMAL AND MECHANICAL ANALYSIS OF WELDED STRUCTURES. Nickell, R. E. (Brown Univ., Providence); Hibbitt, H. D. Nucl. Eng. Des.; 32: No. 1, 110-120(Apr 1975).

The prediction of the residual state of stress and deformation in a welded structure is one of the most interesting, challenging, and complex problems in structural mechanics. The wide spectrum of physical phenomena provides the interest; economic and safety considerations provide the challenge; and the essential nonlinearity of the analytical models provides the complexity. Even if it is assumed that reasonable prediction of the transient temperature field in the structure is possible, determining the residual mechanical state is both a difficult and an expensive task. The analysis inevitably involves temperature-dependent mechanical properties and, in addition, the severe thermal gradients and high temperatures generic to the welding process induce irrecoverable inelastic creep and plasticity in the structure. In spite of this, the stress analysis is not considered to be a straightforward application for general purpose, nonlinear finite element structural programs. A few special features of such analyses, are discussed: (1) the legitimacy of time-dependent plasticity theories for treating the residual stress problem; (2) criteria for choosing plane stress, plane strain, generalized plane strain, or fully three-dimensional models; (3) methods for coping with possible floating solid regions during cooling; and (4) the use of linear constraints to treat weld metal deposition and intermittent contact. Since the most important parameters in the welding process that pertain to the stress analysis are the cooling rate and the welding torch efficiency, the heat transfer problem seems to require a critical look. The dominant features of the problem are: (1) source (torch) characterization; (2) radiation from surfaces that are heated to high temperatures; (3) latent heat effects; and (4) subsidiary considerations, such as enforced convection heat transfer modes that are designed to control the cooling rate. Motion of the welding torch, even at low speeds, is not usually a critical factor in determining the residual mechanical state. Again, finite element analysis is applicable, provided that the solution accuracy can be adequately estimated. Several alternative, two-step, implicit time integration schemes will be compared, especially with regard to accuracy and numerical stability for welding-type problems. The efficacy of "flux correction" is discussed and the application of these ideas to typical industrial welding problems are outlined. (auth)

12026 ETCHING AND PLATING OF U-0.75 Ti AND U-2.3 Nb ALLOYS. Johnson, H. R.; Dini, J. W. (Sandia Labs., Albuquerque, NM). Trans. Am. Nucl. Soc.; 21: 160(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12027 STRESS-STRAIN DATA FOR PREDICTIONS IN MACHINING. Stevenson, M. G. (Oxford Univ.). pp 393-403 of Mechanical Properties at High Rates of Strain. New York; American Inst. of Physics (1974).

From conference on mechanical properties of materials at high rates of strain; Oxford, UK (2 Apr 1974). See Conf-740413-.

The analysis of the machining process, with the aim of predicting the shear angle, tool force and tool temperature for any condition, requires the stress–strain properties of the work material as starting information. Testing conditions appropriate to the primary zone deformation in machining are achievable eco-

nomically with a torsional Hopkinson bar apparatus. The material (Cu–Be, 6Al–4V Ti, etc.) of the elastic bars in this apparatus is selected to maximize the strain rate, and their lengths to maximize the strain. The stress–strain data inferred from a machining steel is compared with a torsion test result on a similar steel at approximately the same strain rate. There is also little difference between the tests in strain, temperature rise and rate of change of temperature with time. The resulting stress levels show fair agreement, but the torsion test gives a substantially lower slope of the stress–strain curve than is inferred from the machining test. Possible reasons for this discrepancy are discussed. (auth)

12028 PRODUCTION OF NIOBIUM COVERINGS BY ELECTROLYSIS OF MOLTEN MEDIA. Kotelevskii, V. A.; Kovalev, F. V.; Ivanovskii, L. E.; Samson, Yu. U.; Kozlov, F. N.; Baranov, I. A. Tr. Inst. Elektrokhim., Ural. Nauch. Tsentr. Akad. Nauk SSSR; No. 21, 56-60(1974). (In Russian).

Data are presented for determining the conditions for the electrolytic deposition of niobium films on various materials. Basic modes of operation are noted, and measurements are made of a number of physical parameters (microhardness, layer thickness, and critical temperature) of samples of niobium coverings. The following salt systems were investigated as electrolytes: KCl–NaCl–$NbCl_5$, KCl–NaCl–K_2NbF_7, and KBr–NaBr–$NbBr_5$. The electrolysis temperature was varied from 650 to 800°C. The cathodic current density was varied from 0.01 to 1 A/cm^2. The niobium deposit is strongly bound to the base material (Ni, Cu, Mo, or Fe), and has a characteristic columnar structure. A diffusion layer does not form at the boundary of the niobium and the base metal. (SJR)

12029 IMPROVEMENTS IN COMPOSITE MATERIALS. Sambrook, D. J. (to Imperial Metal Industries (Kynoch) Ltd.). British Patent 1,381,722/B/. 29 Jan 1975. Filed date 15 Apr 1971. 15p.

Reference is made to composite materials that include bundles of filaments of superconducting material, and to methods of manufacturing same. In the arrangement described each filament is surrounded by, and is in good electrical contact with, a matrix material comprising a high-electrical conductivity metal which is surrounded by a material of lower conductivity. The high conductivity material surrounding the filaments is interrupted by a radially extending wall of the lower conductivity material. Full manufacturing details are given. (UK)

12030 ELECTRON-BEAM WELDING AND TENSILE TEST STUDIES ON MOLYBDENUM AND MOLYBDENUM ALLOYS. Mayer, H. G.; Koeppe, A.; Schaefer, R. (Univ., Stuttgart). High Temp.–High Pressures; 6: No. 4, 383-404(1974). (In German).

From 8th Plansee seminar; Reutte, Austria (27 May 1974).

Molybdenum and molybdenum alloys with Ti, Zr, B, Hf, and C were electron beam (EB) welded. Tensile tests at temperatures up to 1500°C and fatigue tests under pulsating tensile load at 800°C were carried out on unwelded and EB-welded sheet metal specimens. Results established the influence of the alloying elements on the recrystallization behavior and the fracture appearance of molybdenum, and on the grain structure of the weld and of the heat affected zone; the ductility was found to be improved particularly at higher temperatures. The quality of the welds is also affected by the welding parameters and by pre- and postweld heat treatments. By means of a quadrupole mass spectrometer a reduction of impurities in the molten metal was detected. Secondary ion mass spectrometer-photographs showed the alloying elements to be more homogenously dispersed in the coarse-grained fused zone than in the fine-grained base metal. Some examples of EB-welded objects are given. (auth)

12031 CHEMICAL VAPOR DEPOSITION OF TUNGSTEN, TANTALUM, AND MOLYBDENUM BY THE CHLORIDE REDUCTION PROCESS. Shroff, A. M. (Thomson-CSF, Paris). High Temp.–High Pressures; 6: No. 4, 415-421(1974).

From 8th Plansee seminar; Reutte, Austria (27 May 1974).

Chemical vapor deposition of tungsten, tantalum, and molybdenum is described in which the chlorides are produced "in situ" in a chlorination chamber adjoining the reduction chamber. Chlorine reacts with metal chips heated to 850 to 950°C in the chlorination chamber and the resulting chlorides proceed to the lower chamber where the specimen to be coated is heated to 900 to 1100°C in a stream of hydrogen. The rate of deposition is ~1 mm h^{-1}. (auth)

12032 DEVELOPMENT OF BRAZING FILLER METALS FOR MOLYBDENUM. Cole, N. C.; Slaughter, G. M. (Oak Ridge National Lab., TN). Nucl. Technol.; 26: No. 2, 183-191(Jun 1975).

A series of Fe–Mo–C–B and Fe–Mo–Ge–C–B iron-base brazing filler metals was investigated for joining molybdenum. The filler metals exhibited excellent flowability between 1050 and 1200°C. Each brazed molybdenum to itself, and at least two brazed molybdenum to austenitic stainless steels, to nickel, and to carbon steels. Molybdenum-to-molybdenum brazes possessed shear strengths exceeding 30,000 psi (207 MPa) at room temperature, with accompanying elongations exceeding 10 percent. At 650°C the strengths (depending on composition) were 18,000 to 29,000 psi (124 to 200 MPa), with elongations exceeding 42 percent. These alloys showed outstanding corrosion resistance when exposed to either liquid sodium or molten fluoride salts at 600 to 700°C. In addition, the Fe–15 percent Mo–5 percent Ge–4 percent C–1 percent B and Fe–15 percent Mo–4 percent C–1 percent B (by weight) brazing filler metals had satisfactory corrosion resistance when exposed to static or flowing liquid bismuth at 600 to 700°C. When tested in lithium for 800 h at 800°C, the germanium was preferentially leached from the Fe–15 percent Mo 5 percent Ge–4 percent C–1 percent B braze. However, with further development the iron-base filler metals do appear promising for lithium service. (auth)

Properties, Structure, and Phase Studies

Refer also to abstracts 11428, 11494, 11948, 12726, 13050, 13058, 13061, 13120, 13121, 13174, and 13175.

12033 (CONF-731008-, pp 12-29) EXOELECTRON EMISSION, PHENOMENA AND PARAMETERS. Scharmann, A. (Univ., Giessen, Ger.). 1973.

From 4th international symposium on exoelectron emission and dosimetry; Liblice, Czechoslovakia (1 Oct 1973).

In 4th international symposium on exoelectron emission and dosimetry, Liblice, Czechoslovakia, October 1–3, 1973.

A review of the phenomena and parameters governing the effect of exoelectron emission is given. (94 references) (auth)

12034 (EURFNR-1218) DYNAMIC PLASTIC BEHAVIOR OF METALS. Malmberg, T. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Reaktorentwicklung). Sep 1974. Translation of KFK–2023. 144p. Dep. NTIS $5.45.

Work performed under United States–Euratom Fast Reactor Exchange Program.

For FBR safety considerations, it is necessary to know the mechanical properties of structural steels and their equivalents used in model experiments. The present study intends to give a description of phenomena observed in steels with low carbon content (mild steel) and austenitic stainless steels under dynamic plastic deformation. However, dislocation models are not treated. Various constitutive relations used for the analysis of time-dependent plastic flow under uniaxial stress conditions are discussed. Problems related to the interpretation of experiments at higher strain rates ($\dot{\epsilon} > 10^{-1}$) due to elastic plastic wave interactions are described. (auth)

12035 (HEDL-TME-71-49) NOTCH TENSILE AND STRESS RUPTURE PROPERTIES FOR FFTF STRUCTURES. Knecht, R. L.; Steichen, J. M. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Apr 1971. Contract AT(45-1)-2170. 34p. AT.

A literature survey was conducted on notch effects on the tensile and stress rupture properties of austenitic stainless steels. The following conclusions were reached: Type 304 is notch weakened at 1100°F for stress rupture times of 100 to 5000 h, but notch strengthened at 1500°F for rupture lives up to approximately 10,000 h. Type 316 (solution annealed) base or weld metal is not notch weakened at 1100 or 1500°F. Type 347 heat affected zone weld metal, but not base metal, is notch weakened at 1100°F. Type 321 is slightly notch weakened at 1100°F for times of 70 to 2000 h but not at 1500°F. Type 310 is notch strengthened in short-time tensile tests at room temperature. Only limited information is available which is directly applicable to FFTF; no data is available on irradiation effects. (36 references, 18 fig) (DLC)

12036 (HEDL-TME-75-33) EVALUATION OF MECHANICAL PROPERTIES WITH THE LARSON-MILLER PARAMETER. Johnson, G. D. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Apr 1975. Contract AT(45-1)-2170. 42p. AT.

A correlation based on the stress rupture, tensile, tube burst and transient properties of 20% cold worked Type 316 stainless steel has been developed for the temperature range of 700 to 2500°F. This correlation is used to describe the effects of thermal aging, strain rate, and neutron irradiation. (auth)

12037 (HEDL-TME-75-37) SURVEY OF THE EFFECT OF HEAT-TO-HEAT VARIATIONS UPON THE FATIGUE-CRACK PROPAGATION BEHAVIOR OF TYPES 304 AND 316 STAINLESS STEELS. James, L. A. (Hanford Engineering Development

Lab., Richland, Wash. (USA)). May 1975. Contract AT(45-1)-2170. 25p. Dep. NTIS $4.00.

The fatigue-crack growth behavior of four heats of annealed Type 304 stainless steel and three heats of annealed Type 316 stainless steel were studied at elevated temperature using the techniques of linear-elastic fracture mechanics. It is estimated that a factor of 1.5 applied above and below the mean line would provide upper and lower bounds that would account for heat-to-heat variations. In addition, the three heats of Type 316 represented three different melt practices: air-melt, vacuum-arc-remelt, and double-vacuum-melt processes. No effect on fatigue-crack growth behavior was noted due to melt practice. (auth)

12038 (IS-M-40) THERMODYNAMICS OF FORMATION OF Th-Cu ALLOYS. Bailey, D. M.; Smith, J. F. (Ames Lab., Iowa (USA); Iowa State Univ. of Science and Technology, Ames (USA). Dept. of Metallurgy). 1974. 13p. (CONF-741030-13; SM-190/47). Dep. NTIS $4.00.

From symposium on thermodynamics of nuclear materials; Vienna, Austria (21 Oct 1974).

Electromotive force cells have been used to determine the Gibbs free energies, enthalpies, and entropies of formation for $ThCu_6$, $ThCu_{3.6}$, $ThCu_2$, and Th_2Cu over the temperature range 729–1219°K. Solid CaF_2 was used as the electrolyte. Comparison of the present measurements with earlier measurements on the most copper-rich phase shows that the free energies are reproducible by this technique to approximately 4 percent. The magnitudes of the entropies of formation were all measured as less than one cal/g-atom deg and are therefore physically reasonable. The values for the entropies of formation of $ThCu_6$ and $ThCu_{3.6}$ were found to be positive, that of $ThCu_2$ to be essentially zero, and that of Th_2Cu to be negative. Comparison with data from other thorium systems shows that positive entropies of formation are atypical for binary intermetallic phases of thorium. The free energies of formation of the Th–Cu phases were found to be roughly one-half as negative as values reported for Zr–Cu phases at comparable temperatures and stoichiometries. (auth)

12039 (JAPFNR-189) SELF-WELDING BEHAVIOR OF VARIOUS MATERIALS IN SODIUM ENVIRONMENTS. II. Self-Welding of Hard Metals and Carbide Materials. Mizobuchi, S.; Kano, S.; Namekawa, M.; Owada, T.; Atsumo, H. (Power Reactor and Nuclear Fuel Development Corp., Oarai, Ibaraki (Japan). Oarai Engineering Center). Jan 1975. 47p. (N-951-74-12). Dep. NTIS (US Sales Only) $5.50.

Work performed under United States–Japanese Fast Reactor Exchange Program.

Tests of carbide materials, refractory materials such as molybdenum and tungsten as well as stellite No. 6, nickel, nichrome, etc. revealed the following results: (1) Chrome carbide (detonation gun-coated) has a good self-weld resistance, but the carbide with tungsten showed a stron tendency to self-weld. (2) Tungsten and molybdenum had a strong resistance against self-welding. (3) Stellite No. 6 combined with SUS316 showed a tendency to self-welding. (4) Nickel and nichrome showed complete self-welding by forming a diffusion layer in the boundary zone. Thus, it was confirmed that such self-welding phenomena appearing in those components contacting with each other in high-temperature sodium are probelms not to be regarded lightly. (auth)

12040 (KFK-2107) INVESTIGATIONS ON THERMIC STABILITY OF BINARY ALLOYS OF NOBLE METALS WITH ALKALINE EARTH METALS OR LANTHANIDES. Mangelmann, M. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Radiochemie). Feb 1975. 45p. (In German). Dep. NTIS (US Sales Only) $5.25.

The thermal stability of Pt_5Mg, Pt_2Ca, Pt_2Ba, Pt_2Sm, Pt_2Eu, Pt_2Gd, Pt_3Dy, and Pt_3Yb was explored in the temperature range of 800–2000°C. It was shown that under suitable reaction conditions, the ignoble metal of the binary alloy can be distilled off. One could determine reasonable temperature ranges for the distillation of metals by comparing the distilling vapor pressures, the distributions of condensates and the purity of the condensed metals in dependence on temperature. It is shown that the winning of alkaline earth, lanthanide, and actinide metals (B) of noble metal binary alloys AB/sub x + z/ by low-pressure distillation at high temperature by means of cycles with the cycle substance AB/sub x/ can be realized. The following thermodynamic data for the listed binary alloys were determined by the Knudsen effusion method: equilibrium vapor pressures of the ignoble metals, range of melting points of the binary alloys, molar free solution-enthalpy DELTA/sub L/anti G/sub B/ yields AB/sub x/ of the dissolution of the material B in the binary alloy AB/sub x/, and molar free evaporation-enthalpy DELTA/sub V/ anti G for the pure metals Ca, Ba, Sm and Eu at temperatures above 1800°C. (72 references, 25 figures, 8 tables) (DLC)

12041 (N-74-33400) LEVITATION HEATING AND MELTING OF TUNGSTEN, APPENDIX A. Wouch, G. (General Electric Co., Philadelphia, Pa. (USA)). Nov 1973. 24p. NTIS.

The pertinent factors in levitation heating and melting of tungsten are discussed. The benefits to be derived from conducting purification processes in space environments are analyzed. It was determined that the following advantages would be realized: (1) crucibleless heating and melting, (2) vacuum and/or inert gas purification, and (3) control of grain size through supercooling. (STAR)

12042 (N-75-11075) FABRICATION OF TUNGSTEN WIRE REINFORCED NICKEL-BASE ALLOY COMPOSITES. Brentnall, W. D.; Toth, I. J. (TRW Equipment Labs., Cleveland, Ohio (USA)). Oct 1974. 60p. (NASA-CR-134664). NTIS $4.25.

Fabrication methods for tungsten fiber reinforced nickel-base superalloy composites were investigated. Three matrix alloys in pre-alloyed powder or rolled sheet form were evaluated in terms of fabricability into composite monotape and multi-ply forms. The utility of monotapes for fabricating more complex shapes was demonstrated. Results of preliminary 1093°C stress rupture tests indicated that efficient utilization of fiber strength was achieved in composites fabricated by diffusion bonding processes. The fabrication of thermal fatigue specimens is also described. (STAR)

12043 (N-75-11076) HIGH-TEMPERATURE, LOW-CYCLE FATIGUE OF ADVANCED COPPER-BASE ALLOYS FOR ROCKET NOZZLES. Part II: NASA 1.1, Glidcop, and Sputtered Copper Alloys. Contractor Report, Mar.–Sep. 1974. Conway, J. B.; Stentz, R. H.; Berling, J. T. (Mar-Test, Inc., Cincinnati, Ohio (USA)). Nov 1974. 50p. (NASA-CR-134628). NTIS $3.75.

Short-term tensile and low-cycle fatigue data are reported for five advance copper-base alloys: Sputtered Zr–Cu as received, sputtered Zr–Cu heat-treated, Glidcop AL-10, and NASA alloys 1-1A and 1-1B. Tensile tests were performed in argon at 538°C using an axial strain rate of 0.002/s. Yield strength and ultimate tensile strength data are reported along with reduction in area values. Axial strain controlled low-cycle fatigue tests were performed in argon at 538°C using an axial strain rate of 0.002/s to define the fatigue life over the range from 100 to 3000 cycles for the five materials studied. It was found that the fatigue characteristics of the NASA 1-1A and NASA 1-1B compositions are identical and represent fatigue life values which are much greater than those for the other materials tested. The effect of temperature on NASA 1-1B alloy at a strain rate of 0.002/s was evaluated along with the effect of strain rates of 0.0004 and 0.01/s at 538°C. Hold-time data are reported for the NASA 1-1B alloy at 538°C using 5 minute hold periods in tension only and compression only at two different strain range values. Hold periods in tension were much more detrimental than hold periods in compression. (STAR)

12044 (ORNL-TM-1763) EVALUATION OF HASTELLOY N TUBES FOR SNAP-8 APPLICATIONS. McCoy, H. E.; Weir, J. R. (Oak Ridge National Lab., Tenn. (USA)). Apr 1967. Contract W-7405-eng-26. 38p. Dep. NTIS $5.00.

Decalssified 31 Aug 1973.

The results of a brief study on Hastelloy N cladding material for SNAP-8 application are described. The alignment problem encountered in running axial tensile tests on tubes has been studied. A gripping technique was developed that reduced the bending stress to about 5% of the axial stress. Tensile tests on circular tube segments have been run, and the results compare favorably with those obtained in axial tube tests at 650°C and higher. Variations in the grain size of the chromized tubes and those tubes exposed to a thermal cycle duplicating that of the chromizing process have not been fully explained. However, the effect is thought to be largely associated with nonuniform working of the tubing during the final fabrication steps. Electron microprobe studies showed that chromium diffused into the Hastelloy N. The possibility of the chromium diffusing along grain boundaries to appreciable depths during service is pointed out. (29 fig, 4 tables) (auth)

12045 (RD/B/M-2479(Rev.2)) THERMODYNAMIC AND TRANSPORT PROPERTIES OF LIQUID SODIUM. Durham, M. E. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Nov 1974. 31p. (CFR/THWP/P-(72)28(Rev. 2)). Dep. NTIS (US Sales Only) $4.75.

The thermodynamic and transport properties of saturated liquid sodium are presented in graphical and tabular form. Analytic expressions are also given from which the value of the particular property may be found as a function of temperature. International system (SI) units are used throughout. The properties of the sub-cooled liquid can be assumed equal to those of the saturated liquid at the same temperature, with negligible error. Conversion factors are given which enable the data to be ex-

pressed in Imperial and cgs units. This revision has been necessitated by a recently discovered error in the Golden and Tokar data for specific heat at constant volume. (auth)

12046 (RDT-M-8-1T(5-75)) HELICAL AGE-HARDENABLE NICKEL–CHROMIUM–IRON ALLOY SPRINGS. (USAEC Division of Reactor Research and Development, Washington, D.C.). May 1975. 14p. RSO.

A standard prescribing requirements for helical age-hardenable nickel–chromium–iron alloy springs for nuclear and associated applications is presented. This standard supersedes RDTM 8-1T, dated February 1973. (JRD)

12047 (UCRL-51682(Pt.6)) BEHAVIOR OF POROUS BERYLLIUM UNDER THERMOMECHANICAL LOADING. Part 6. Effect of Pressure on the Microstructure of Plasma-sprayed Beryllium. Hanafee, J. E.; Snell, E. O. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 8 Apr 1975. Contract W-7405-Eng-48. 36p. Dep. NTIS $4.00.

The effects of pressure and specimen preparation on the microstructure of two grades of porous plasma-sprayed beryllium were determined. One grade, P-1, was sintered after spraying while the other grade, P-10, was tested in the as-sprayed condition. The principal microstructural characteristics studied were grain size, grain morphology, and void distribution and size. It was found that machining can readily cause a significant dense surface layer on the porous beryllium specimens, and that the dense surface layer can be removed by etching. There was substantial difference in microstructure between the P-1 sintered and P-10 unsintered specimens both before and after being subjected to shock waves and static compression. (auth)

12048 (UCRL-51812) CHARACTERIZATION OF ASTM ROUND-ROBIN TUNGSTEN-POWDER SAMPLES. Slettevold, C. A.; Biermann, A. H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 15 May 1975. Contract W-7405-Eng-48. 18p. Dep. NTIS $4.00.

The Lawrence Livermore Laboratory Particle Characterization Laboratory Group has participated in an industry-wide round-robin investigation on characterization of tungsten powder sponsored by the ASTM Subcommittee on Refractory-Metal Powders (B-09.3). The analyses performed at the suggestion of the ASTM subcommittee included measurements of tap density, apparent density, true density, average particle size, and surface area. Determinations of particle-weight and size distributions were also performed and particle inspection conducted by microscopy. This report describes the equipment and procedures used and summarizes the results of these analyses. (9 tables, 17 fig) (auth)

12049 (ZFK-283, pp 96-97) ELECTRIC QUADRUPOLE INTERACTION IN ZrHf AND TiHf ALLOYS WITH LOW Hf CONTENT. Unterricker, S.; Hausbrand, J. (Bergakademie, Freiberg i.B.). Aug 1974. (In German).

In joint annual report, 1974.

12050 (ZFK-283, pp 100-101) STUDY OF THE TRANSITION METAL OXIDE VO_2 WITH PERTURBED ANGULAR CORRELATIONS. Andreeff, A.; Lehnert, K.; Unterricker, S. (Bergakademie, Freiberg i.B.). Aug 1974. (In German).

In joint annual report, 1974.

12051 DEFORMATION MECHANISM MAPPING OF α-Zr AND ZIRCALOY-2. Knorr, D. B.; Notis, M. R. (Lehigh Univ., Bethlehem, Pa. (USA). Dept. of Metallurgy and Materials Science). J. Nucl. Mater.; 56: No. 1, 18-24(Apr 1975).

Deformation mechanism mapping has recently evolved as a method for quantitatively expressing complex deformation equations while at the same time allowing visual insight into understanding of these deformation processes. Techniques for the generation of deformation mechanism maps are described and specific application to creep of α-Zr and Zircaloy-2 is demonstrated. Because these maps increase the physical understanding of observed relations, they therefore increase the confidence with which data may be extrapolated beyond the range of experiments. It is this predictive–extrapolative feature of deformation mechanism maps that makes them extremely interesting, for example, insofar as applications to nuclear materials. (auth)

12052 THE STRUCTURE OF ZIRCONIUM–ALUMINIUM INGOTS CONTAINING 7.6 TO 9.8 WT% ALUMINIUM. Schulson, E. M. (Atomic Energy of Canada Ltd., Chalk River, Ontario). J. Nucl. Mater.; 56: No. 1, 38-46(Apr 1975).

A metallographic study was carried out to examine non-equilibrium structures formed on cooling arc-melted Zr–7.6 to 9.8 wt% Al alloys of commercial purity. These compositions bracket the potentially useful phase Zr_3Al. The cast Zr–7.6 to 9.0 % Al alloys are characterized by a Zr(Al)/Zr_2Al duplex structure, the origin of which is shown to be precipitation during cooling of Zr_2Al particles within a β–Zr(Al) solid solution which formed from the melt. The cast Zr–9.8% Al alloy is characterized by a mixture of Zr(Al) and Zr_5Al_3 plus Zr_2Al precipitates within the Zr(Al) phase, features which are attributed in part to solidification of a β–Zr(Al)/Zr_5Al_3 eutectic. Quantitative experiments show that the average size of the Zr_2Al precipitates, l, is proportional to the cube root of the transit time through the β–Zr + Zr_2Al two-phase field, $(\Sigma t_{Zr/Zr_2Al})^{1/3}$. (auth)

12053 LOW-CYCLE FATIGUE PROPERTIES OF ZIRCALOY-2 CLADDING. Pettersson, K. (Aktiebolaget Atomenergi, Studsvik (Sweden)). J. Nucl. Mater.; 56: No. 1, 91-102(Apr 1975).

The low-cycle fatigue properties of specimens of recrystallized Zircaloy-2 cladding were investigated using a bend-testing rig at 20, 250, 300, 350, and 400°C. The results followed the Coffin-Manson law for low-cycle fatigue at all temperatures. Irradiated specimens were tested at 20 and 300°C. At 20°C the life of irradiated specimens was shorter than that of unirradiated specimens, whilst at 300°C the irradiated specimens fall on the same Coffin-Manson plot as the unirradiated specimens. Generally the number of cycles to failure in the present investigation was a factor of three smaller than in other investigations using push-pull testing machines. Fracture surfaces were investigated in a scanning electron microscope in order to determine the characteristic features of low-cycle fatigue failures. Twins found along the path of the fatigue cracks were explained as being a consequence of the cracks rather than as promoters of crack propagation. (auth)

12054 LOW TEMPERATURE ^{93}Nb NUCLEAR SPIN-LATTICE RELAXATION IN Nb AND Nb–Mo ALLOYS. Fradin, F. Y.; Huguelet, B. C. (Argonne National Lab., Ill. (USA)). Phys. Lett., A; 51: No. 5, 269-270(24 Mar 1975).

High accuracy ^{93}Nb nuclear spin-lattice relaxation data are presented for Nb, $Nb_{0.75}Mo_{0.25}$, and $Nb_{0.70}Mo_{0.30}$ between 1.7 and 4.2 K. $(T_1T)^{-1}$ is independent of temperature and scales as the square of the density of states at the Fermi level. (auth)

12055 FERRIMAGNETISM IN $SmFe_2$. Dublon, G.; Dariel, M. P.; Atzmony, U. (Israel Atomic Energy Commission, Beersheba. Nuclear Research Center-Negev). Phys. Lett., A; 51: No. 5, 262-264(24 Mar 1975).

Magnetization measurements of polycrystalline $SmFe_2$ are interpreted in terms of a ferrimagnetic coupling between the Sm^{+3} and iron moments. A sign reversal of $\langle S_z \rangle$ relative to $\langle L_z + S_z \rangle$ is obtained by single-ion crystal-field calculations of the Sm^{+3} moment. (auth)

12056 LEGIROVANIE DEFORMIRUEMYKH ALYUMINIEVYKH SPLAVOV PEREKHODNYMI METALLAMI. (Alloying Deformable Aluminum Alloys with Transition Metals). Elagin, V. I. Moscow; Metallurgiya (1975). 248p.

Experimental data on the alloying of deformable Al alloys with the transition metals Mg, Cr, Ti, Zr, V, and Ni are generalized. Data are reported on the effects of transition metals on the structure and the mechanical and corrosion properties of a series of deformable alloys. On the basis of an analysis of the experimental data, general laws on the alloying of Al were established. Recommendations were made on the practicality of alloying Al with different transition metals. (tr-auth)

12057 OBRABOTKA DAVLENIEM TUGOPLAVKIKH METALLOV I SPLAVOV. (Fusion Processing of Refractory Metals and Alloys). Korneev, N. I.; Pevzner, S. B.; Razuvaev, E. I.; Emel'yanov, V. B. Moscow; Metallurgiya (1975). 440p.

The thermomechanical parameters of the fusion processing of refractory metals and alloys are reported. The metals discussed are Mo, Nb, Cr, W, Ta, V, and Re and their alloys. The methods for the manufacture of different semi-finished products from these metals and alloys using compression, forging, stamping, rolling, and drawing are examined. (JSR)

12058 EFFECT OF MOLYBDENUM, NIOBIUM, AND TANTALUM ON THE STRUCTURE AND PROPERTIES OF ALLOYS BASED ON TUNGSTEN. Pryakhina, L. I.; Polyakova, R. S.; Myachikova, K. P.; Ozhimkova, O. V.; Gromova, V. G. Izv. Akad. Nauk SSSR, Metal.; No. 2, 180-184(1975). (In Russian).

A study was made of the effect of Mo, Nb, and Ta on the hardness of binary and ternary alloys of W at room temperature and at higher temperatures. Tantalum showed the greatest strengthening effect on tungsten. Niobium and molybdenum strengthen tungsten to a lesser degree. The regularity in the change of hardness of tungsten alloys containing Nb, Ta and Mo agrees well with the change in lattice constant of these alloys and with compressibility values of the interacting atoms. (SJR)

12059 STUDY OF A NUMBER OF PHYSICAL PROPERTIES OF Ti–Zr ALLOYS. Shushkanov, V. M. Izv. Akad. Nauk SSSR, Metal.; No. 2, 185-188(1975). (In Russian).

A study is carried out of the modulus of elasticity, paramagnetic susceptibility, and a number of the mechanical properties of titanium alloys with 2 to 15% Zr which were subjected to various thermal treatments. (SJR).

12060 MOLYBDENUM CORNER OF THE TERNARY Mo–Mn–C SYSTEM. Zakharov, A. M.; Kurganov, G. V.; Danielyan, T. A.; Uverskaya, T. A. Izv. Akad. Nauk SSSR, Metal.; No. 2, 194-197(1975). (In Russian).

Using metallographic, x ray, and electronographic analyses and measurements of the initial melting temperatures and the microhardness of the alloys a study was carried out of the molybdenum corner of the ternary Mo–Mn–C system (up to 0.4% Mn and 0.2% C). Isothermal cuts of the system were constructed at temperatures of 1800, 1600 and 1200°C, and polythermic cuts were constructed at a constant content of carbon (0.02 and 0.09%) and at Mn : C ratios of 2 : 5 and 1 : 1. The binary alloy Mo–10% Mn is a solid solution of manganese replacement in molybdenum. Correspondingly, the solubility of manganese in molybdenum exceeds 10% in the temperature interval from 1200 to 1800°C. In ternary alloys of Mo–Mn–C at temperatures of 1200 to 1800°C in equilibrium with a molybdenum, alpha solid solution, there is a carbide phase $(Mo,Mn)_2C$ or a solution of manganese in the carbide Mo_2C with an hcp-lattice. Manganese decreases the lattice constants on dissolving in molybdenum and in the carbide Mo_2C. Additions of manganese to alloys of the binary system Mo–C decrease the rather insignificant solubility of carbon in molybdenum in the solid state, especially at high temperatures (1600 and 1800°C). (SJR)

12061 EFFECT OF ZIRCONIUM ON PHASE CONVERSIONS IN Ti–Nb ALLOYS. Kadykova, G. N.; Gadzoeva, M. M. Izv. Akad. Nauk SSSR, Metal.; No. 2, 198-204(1975). (In Russian).

A study of the effect of Zr additions on phase conversions in titanium alloys containing 25 to 50% Nb showed that in alloys containing 25 to 40% Nb the formation of a τ-phase during cold deformation is made more difficult. The region of the most intensive formation of an ω-phase in quenched alloys is shifted on addition of zirconium to the side of a smaller niobium content. The amount of ω-phase, which forms on aging cold-deformed alloys, at the same niobium content, is greater in alloys containing zirconium. This behavior is associated with an increased temperature of formation of the α-phase here. (SJR)

12062 STUDY OF THE Zr–V–Ga SYSTEM. Kreidenko, F. S.; Sokolovskaya, E. M.; Zubchenko, V. S.; Markiv, V. Ya. Izv. Akad. Nauk SSSR, Metal.; No. 2, 205-208(1975). (In Russian).

By the methods of x-ray and microstructural analyses, an isothermal cross-section was constructed for the ternary phase diagram of Zr–V–Ga at 800°C, which is characterized by the presence of eight ternary phases: $\lambda_1\lambda^*$, X, YX', X'', W and X°. The ternary phase λ_1 has a structure of the type $MgZn_2$. The structures of the remaining phases were not established. (SJR)

12063 STUDY OF THE MECHANICAL PROPERTIES OF Ti–V–Nb–W ALLOYS WITH THE USE OF THE SIMPLEX-CENTROID METHOD. Levanov, V. I.; Sobolev, N. N.; Mikheev, V. S.; Elyutin, O. P. Izv. Akad. Nauk SSSR, Metal.; No. 2, 211-215(1975). (In Russian).

The use of a simplex-centroid method of planning experiments on investigating the tensile strength and relative elongation of Ti–V–Nb–W alloys containing (V + Nb + W) up to 12 wt % made it possible, by carrying out a small number of experiments, to construct mathematical equations describing the properties under investigation as a function of alloy composition for temperatures from −196 to +20°C. From these equations it is possible to calculate with satisfactory accuracy values of the tensile strength and relative elongation of the alloys, as was confirmed by comparing the experimental and calculated values of the properties for 10 control alloys. These results make it possible to construct composition-property diagrams for various cuts in the Ti–V–Nb–W system, and also to select alloys having given properties of tensile strength and relative elongation at −196 and +20°C. (SJR)

12064 THERMODYNAMIC PROPERTIES OF LIQUID ALLOYS OF In–Zn–Hg. Kozin, L. F.; Nigmetova, R. Sh.; Smirnova, O. Ya. Izv. Akad. Nauk SSSR, Metal.; No 2, 216-220(1975). (In Russian).

A study was made of the thermodynamic properties of liquid, In–Zn–Hg alloys by measuring the vapor pressure of mercury. Both positive and negative deviations from ideal behavior are observed in the system. (SJR)

12065 TEXTURE STRENGTHENING OF TITANIUM AND ZIRCONIUM. Ageev, N. V.; Babareko, A. A. Izv. Akad. Nauk SSSR, Metal.; No. 2, 81-90(1975). (In Russian).

During deformation of titanium alloys in the temperature region of the existence of the alpha phase, the main mechanism determining texture development is deformation. Alloying with element-stabilizers of the alpha or beta phases changes the tendency to dislocation splitting along the basal, and stimulates the development of basal or twinned basal texture. During deformation of titanium alloys in the temperature region of beta-phase existence, the texture of the converted alpha phase is determined both by the deformation texture and (or) recrystallization of the beta-phase, and also by the orientation of the external applied stresses with respect to the internal stresses arising during the reverse conversion. By a change in deformation conditions such as temperature, degree and rate of reduction, and also direction of the main deformations, it is possible to vary the type of texture of alpha- and alpha plus beta-titanium alloys over wide limits and to obtain useful orientations for making articles from these alloys. In the alpha-alloy, because of an improvement in texture, the strength as used in construction is increased by 45%. In thermally strengthened alpha + beta-alloys of titanium having a low plasticity, by developing given orientations, it is possible to avoid texture disordering and to use the effect of thermic strengthening under conditions of rigid, two-axial stressing. (SJR)

12066 DETERMINING THE NATURE OF EXCESS PHASES IN THE ALLOY CrNi50MBVYU (EP-691). Sveshnikova, G. A.; Zimina, L. N.; Yakovleva, E. F.; Zharkova, D. N. Izv. Akad. Nauk SSSR, Metal.; No. 2, 112-116(1975). (In Russian).

Using phase, electrochemical, and x-ray structural analyses, a study was made of the composition and structure of excess phases in alloy EP-691 (14.4 wt % Cr, 8.0% Mo, 5.1% W, 5% Nb, 1.1% Al, 9.8% Fe, 0.03% C, and nickel). The alloy was preliminarily subjected to air quenching from 1150°C and to aging at 700 to 850°C for various lengths of time. Depending on the modes of thermal treatment, strengthening phases may be present, including Ni_3Nb with fcc or rhombic lattice, a μ-phase of the type M_7W_6 (M is a metal atom), a carbide M_6C, and a carbonitride Nb(C,N). The lattice constant of the metastable, face-centered phase Ni_3Nb is close to the lattice constant of the main solid solution, and ranges from 3.59 to 3.60 Å. The composition of the phase can vary depending on the thermal treatment. In comparison with the solid solution, the Ni_3Nb phase is enriched in niobium and aluminum, depleted in chromium, iron, molybdenum and tungsten, and, in a general way, it can be represented as $(Ni,Cr,Fe)_3(Nb,Al)$. The lattice constants of the equilibrium, rhombic phase Ni_3Nb are equal to: a = 5.08 Å; b = 4.24 Å; c = 4.57 Å (a:b:c = 2.00:1.67:1.8). The hexagonal μ-phase of the type M_7W_6 has approximately the following chemical composition: 31 wt % Mo, 27% W, 20% Ni, 12% Cr, 6% Fe, and 4 wt % Nb. The carbide M_6C contains 25 wt % Ni, 23% Nb, 15% Mo, 10% Cr, 9% W, and 6 wt % Fe. The chemical formula can be represented as $(Ni,Cr,Fe)_3(Mo,W,Nb)_3C$. The lattice constant of the M_6C type of carbide is equal to 11.3 Å. (SJR).

12067 CHANGE IN MECHANICAL PROPERTIES OF A SOLID ALLOY DURING PLASTIC DEFORMATION. Ivensen, V. A.; Fal'kovskii, V. A.; Chumak, I. V.; Proshkina, T. N. Izv. Akad. Nauk SSSR, Metal.; No. 2, 140-144(1975). (In Russian).

The change in properties of the solid alloy WC–Co during plastic deformation is caused by both deformation strengthening and weakening associated with the formation of submicroscopic defects. Weakening effects are manifested more strongly during deformation of fine-grained, low-cobalt alloys which have the highest resistance to deformation. An obvious anisotropy in properties was found in a solid alloy deformed by single-axial compression. The anisotropy in properties is explained hypothetically by the formation of plane, submicroscopic defects which are oriented with respect to the single-axial compression. (SJR).

12068 DIFFUSION IN BCC-METALS. Zagryazkin, V. N.; Ushakov, B. F.; Meshcheryakov, G. Ya. Izv. Akad. Nauk SSSR, Metal.; No. 2, 156-161(1975). (In Russian).

Correlation relations are established between the thermodynamic properties of metals and the diffusion parameters (ΔH and D_0) for transition metals of groups V and VI (V, Nb, Ta and Cr, Mo, W). The entropy of movement during self-diffusion and the diffusion of impurity replacement atoms in bcc-metals is much smaller than the entropy of vacancy formation. A calculation is made of the coefficients of self-diffusion and diffusion of replacement impurities in bcc-metals, and the results are in satisfactory agreement with experimental determinations. (SJR).

12069 INFLUENCE OF MANUFACTURING CONDITIONS ON MECHANICAL PROPERTIES AND PARTICULARLY ON CREEP STRENGTH OF FUEL CANS. Frenkel, J. M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Recherches Metallurgiques Appliquees). Mec., Mater., Electr.; No. 300, 14-19(Dec 1974). (In French).

The transverse creep strength of zircaloy fuel cans under biaxial stresses increases very clearly with the temperature of the final annealing. This effect results from an evolution, during annealing of the texture responsible for the plastic anisotropy of the material. (FR)

12070 INFLUENCE OF THERMOPLASTIC TREATMENTS ON THE PROPERTIES OF A Cr-Mo STEEL. Comparison Between Cast, Forged and Pressed Steel. Crouzatier, T.; Detrez, P. (Centre Technique des Industries de la Fonderie, 75 - Paris (France)); Makiguchi, T. (National Research Inst. for Metals, Tokyo (Japan)); Pienard, E. (Institut Universitaire de Technologie, 92 - Ville-d'Avray (France)). Mem. Sci. Rev. Metall.; 71: No. 11, 673-689(Nov 1974). (In French).

From autumn meeting on metallurgy; Paris, France (30 Sep 1974).

The mechanical tests carried out in longitudinal and transverse directions are described. The fracture surfaces were observed using scanning electron microscopy. The influence of the austenitic grain size, microsegregates and micropores on the mechanical properties of the steel was studied. (FR)

12071 STUDY OF STRUCTURE CHANGES IN MARAGING STEELS BY MOESSBAUER SPECTROMETRY. Courrier, R.; Le Caer, G. (Ecole Nationale Superieure de la Metallurgie et de l'Industrie des Mines, 54 - Nancy (France)). Mem. Sci. Rev. Metall.; 71: No. 11, 691-709(Nov 1974). (In French).

From autumn meeting on metallurgy; Paris, France (30 Sep 1974).

The structure changes studied in the maraging steels Fe-Ni-Mo and Fe-Ni-Co-Mo by Moessbauer spectroscopy enabled observation of the clustering of Mo atoms in the as-quenched alloys and the formation of precipitates resulting from the dissolution of the Mo atom clusters, this precipitation being followed by the formation of the intermetallic compound $(Fe,Ni)_2Mo$. The influence of Ni and Mo is discussed. Mo atom clustering explains the hardening of the alloys. Ni accelerates the precipitation kinetics and the clustering of the Mo atoms. (FR)

12072 ELECTRON SPECTROMETRY (ESCA) STUDY OF ELECTRON BINDING ENERGY IN METALLIC NIOBIUM AND OXIDES NbO, NbO_2 AND Nb_2O_5. Caillat, R.; Fontaine, R.; Feve, L.; Guittet, M. J. (Institut Universitaire de Technologie, 91 - Orsay (France); CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Service d'Etudes Analytiques). C. R., Ser. C.; 280: No. 4, 189-191(27 Jan 1975). (In French).

Electron binding energy in niobium atoms was measured by photoelectron spectroscopy (ESCA) in metallic niobium and different oxides. The results obtained improve and complete literature data. (FR)

12073 STRUCTURAL CHANGES IN A Ti-35 Nb ALLOY DURING QUENCHING AND TEMPERING. Piejewski, J.; Texier, C.; Cizeron, G. (Institut National des Sciences et Techniques Nucleaires (INSTN), Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Lab. de Metallurgie; Paris-11 Univ., 91 - Orsay (France)). C. R., Ser. C.; 280: No. 4, 173-176(27 Jan 1975). (In French).

According to the mode of quenching carried out on the homogenized state at 900 C, a martensitic structure (α'' or ω type) may be developed. Tempering of α'' martensite leads either to direct reversion to the β phase or to the transitory formation of ω with a noticeable increase in hardness. (FR)

12074 NEUTRON DIFFRACTION STUDY OF THE STRUCTURE OF LIQUID CERIUM AND PRASEODYMIUM. Bellissent, R.; Tourand, G. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique du Solide et de Resonance Magnetique). J. Phys. (Paris).; 36: No. 1, 97-102 (Jan 1975).

The structure factors of liquid cerium and praseodymium was determined at 1100°C using neutron diffraction. For theoretical and experimental reasons paramagnetic scattering was assumed to be identical in both liquid and solid states. The pair correlation functions, neighbor distances and coordination number were then obtained by Fourier transform. The structure factor S(k) exhibits an anomalous behavior compared with simple metallic ions. (FR)

12075 A STUDY OF THE BEHAVIOUR OF A MOLYBDENUM SINGLE CRYSTAL SHEARED PARALLEL TO THE (110) PLANE IN VARIOUS DIRECTIONS WITHIN THIS PLANE. Millour, J. P.; Kobylanski, A.; Goux, C. (Ecole Nationale Superieure des Mines, 42 - Saint-Etienne (France). Dept. de Metallurgie). C. R., Ser. C.; 280: No. 7, 431-434(17 Feb 1975). (In French).

When a molybdenum single crystal is sheared parallel to a (110) plane in any direction within this plane the deformation can be considered as the result of two shears along the two (111) directions. The resolved shear stresses along these directions depend upon the imposed shear direction: the lowest value of the resolved shear stress is obtained when the crystal is sheared parallel to (100). Irrespective of the shear direction the ratio of the contributions of these two shears along the (111) directions remains constant throughout the deformation. (FR)

12076 CONSTRUCTION OF A HIGH TEMPERATURE DIFFRACTOMETER (3200 DEG C) AND APPLICATION TO THE STUDY OF ZrO_2 AT HIGH TEMPERATURE. Hubert, J. (Centre National de la Recherche Scientifique, 94 - Vitry-sur-Seine (France). Centre d'Etudes de Chimie Metallurgique). Rev. Int. Hautes Temp. Refract.; 11: No. 4, 253-262(Oct 1974). (In French).

A high temperature X ray diffraction device capable of studying samples up to 3200 C in air or controlled atmosphere was built. The apparatus is made of a Bragg-Brentano type diffractometer associated with an image furnace. The device was applied to the study of the structure of zirconia ZrO_2 at high temperature. (FR)

12077 HIGH TEMPERATURE THERMOMECHANICAL TREATMENTS OF AUSTENITIC STAINLESS STEELS OF THE Z6 CND 17-13 B TYPE. Henry, G.; Michaut, B.; Rofes-Vernis, J.; Rossard, C. (Institut de Recherches de la Siderurgie Francaise (IRSID), 78 - Saint-Germain-en-Laye). Rev. Metall. (Paris).; 71: No. 12, 897-904(Dec 1974). (In French).

From 13th meeting on alloy steels; Saint-Etienne, France (16 May 1974).

Hot torsion tests were used to study the properties of stainless steels of the Z6 CND 17-13 B type. Hot rolling schedules were developed to produce steels with a workhardened structure and a fine and homogeneous grain without the use of accelerated cooling. (FR)

12078 STUDY OF THE CRACK INITIATION AND FATIGUE CRACKING RATE FOR CERTAIN AUSTENITIC STAINLESS STEELS. Rabbe, P.; Amzallag, C. (Societe Creusot-Loire, 42 - Unieux (France)). Rev. Metall. (Paris).; 71: No. 12, 931-941(Dec 1974). (In French).

From 13th meeting on alloy steels; Saint-Etienne, France (16 May 1974).

The operational behavior of the austenitic stainless steels Z2 CN 18-10, Z6 CN 18-10, Z2 CND 17-12 and Z3 CND 17-12 was studied. Repeated tensile tests were carried out at room temperature and 320 C. The number of cycles necessary for the initiation of a crack as a function of the sharpness of the machined notch was determined together with the coefficients of the Paris law and the threshold for the absence of fatigue cracks. (FR)

12079 INFLUENCE OF THE BORON CONTENT ON THE HOT-CRACKING TENDENCY IN THE HEAT-AFFECTED ZONE OF WELDED AUSTENITIC STAINLESS STEELS 18-10. Donati, J. R.; Guttmann, D.; Zacharie, G. (Electricite de France, 77 - Ecuelles). Rev. Metall. (Paris).; 71: No. 12, 917-930(Dec 1974). (In French).

From 13th meeting on alloy steels; Saint-Etienne, France (16 May 1974).

The mechanism involved in the effect of boron on hot cracking was studied in stainless steels of the Z6CNT18-12B type. This study enabled the boride formation during fast heat treatments to be observed and a boron homogenizing treatment to be developed. The boride formation being dependent on steel composition, Gleeble tests and microstructure examinations were also performed on stainless steels of the Z6CND17-13B and Z6CNDT17-13B type. (FR)

12080 EVALUATION OF THE TENDENCY TO HOT CRACKING IN THE HEAT-AFFECTED ZONE OF WELDED AUSTENITIC STAINLESS STEELS 18-10. Discussion of a Cracking Criterion. Donati, J. R.; Zacharie, G. (Electricite de France, 77 - Ecuelles). Rev. Metall. (Paris).; 71: No. 12, 905-915(Dec 1974). (In French).

From 13th meeting on alloy steels; Saint-Etienne, France (16 May 1974).

The hot cracking of austenitic stainless steel 18-10 welded joints was studied using the Gleeble and Varestraint tests. The two tests are described and a criterion for cracking is discussed. The correlation of the results yielded by these two types of test is very satisfactory. (FR)

12081 CONSTITUTION OF THE MAGNESIUM—INDIUM SYSTEM NEAR THE COMPOSITION OF Mg_3In AND PHASE TRANSITION OF $beta_1$ PHASE. Watanabe, Y. (Tohoku Univ., Sendai). Acta Metall.; 23: No. 6, 691-696(Jun 1975).

The phase diagram of the Mg-In system was re-examined, as there was some uncertainty as to the phase transition of $beta_1$ phase in the literature. It was found that the direct transition of $beta_1$ to beta' phase is prevented by the two phase region in the

whole composition range investigated. In addition to this, location of Mg_2In_2 phase ($beta_3$ phase) in the diagram was for the first time made clear. $Beta_3$ phase is stable only below 210°C and decomposes into beta' and $beta_2$ phases above this temperature. The confirmation of the crystal structure of $beta_1$ phase was also done on single crystal electron diffraction patterns. Mg_3In changes its structure from ordered 12R to disordered fcc through ordered 3R with increasing temperature. The transformation energy associated with the change in the stacking sequence (12R yields 3R) and that associated with the order-disorder phase change were estimated by specific heat measurements to be approximately 120 cal/mole and approximately 340 cal/mole, respectively. (auth)

12082 INTERRELATIONSHIP BETWEEN SLIP AND TWINNING IN BCC CRYSTALS. Mahajan, S. (Bell Labs., Murray Hill, NJ). Acta Metall.; 23: No. 6, 671-684(Jun 1975).

The crystallographic features of faults and twins in their early stage of development from slip dislocations were examined in detail in deformed Mo–35 at. percent Re alloy specimens by transmission electron microscopy. The circumstantial evidence thus developed can be rationalized in terms of the "[112] slip band conversion" model. It is envisaged that three-layer twins form by the dissociation of 1/2(111) screw dislocations, and a macroscopic twin evolves when three-layer twins located at different levels within a slip band grow into each other. Implications of this suggestion to various features of the twinning phenomenon are also discussed. The crystallography of slip structures originating from blocked or stopped twins was ascertained and correlated with that of the twins. The observed correlations can be explained on the basis of Hull's and Sleeswyk's hypotheses for the origin of slip dislocations from twin tips. The preceding observations are consistent with a reaction that interrelates slip and twinning phenomena. (auth)

12083 EFFECT OF DOPING ADDITIVES ON THE FORMATION OF BUBBLES IN TUNGSTEN. Yamazaki, S.; Koseki, I.; Ogura, S.; Akiyama, R. (Tokyo Shibaura Electric Co., Ltd., Yokohama, Japan). Planseeber. Pulvermet.; 22: No. 4, 243-263(Dec 1974).

The effect of dopants on the reduction of tungsten oxides to metal powders and on the inclusion of aluminum, silicon, and potassium in metal particles has been investigated. Another investigation has been carried out to examine the relation between dopant concentration in tungsten metal particles and the density of rows of bubbles and the shape of recrystallized grains in annealed wires. K_2O and SiO_2, doped at the same time, cause α-W and β-W to be formed relatively early in the reduction process. Therefore, at a further stage, it accelerates the formation of growing α-W particle and, consequently, causes silicon and potassium to be included in tungsten metal particles. With additional Al_2O_3 to K_2O and SiO_2 as dopant, β-W formed at an early stage of the reduction process and aluminum and especially potassium concentration in tungsten metal powders increase proportionally. During sintering, aluminum and silicon volatilize easily and remain in less than 0.003 weight percent in the sintered ingots. However, only potassium remains significantly, about 55 to 70 percent of its contents in tungsten metal powders. The potassium concentration in the wires increases with them in the tungsten metal powders. With the increase of potassium concentration in wires, the density of rows of bubbles increases almost monotonically and the elongated recrystallized grains are easily formed. Additional Al_2O_3 to K_2O and SiO_2 as dopant increases potassium included in tungsten metal particles and, therefore, results in increasing the contents of potassium rather than aluminum in wires. Consequently, this factor contributes to the formation of numerous rows of bubbles and of large elongated recrystallized grains. (auth)

12084 MODEL AND ON THE MECHANISM OF RECRYSTALLIZATION OF DOPED TUNGSTEN WIRES. Berghezan, A.; Fourdeux, A. (Univ. Catholique de Louvain, Louvain-la-Neuve, Belgium). Planseeber. Pulvermet.; 22: No. 4, 264-284(Dec 1974).

The increase in recrystallization temperature with increase in the degree of deformation of doped W wires was examined. It is suggested that the exaggerated grain-growth observed in the wires having diameters smaller than 500 microns is associated with an appropriate critical dispersion of bubbles in the rows as well as with an appropriate critical (minimum) distance between the rows. This suggestion is based on the numerous observations by transmission electron microscopy of both undoped and doped tungsten wires. These observations made it possible to detect both the dispersion of the second-phase doping material, as well as the dislocation structure developed during drawing in the filaments and its evolution during annealing. It was thus possible to find out why such a small amount of the doping material in the wires has such an influence on the evolution of the structure during annealing up to very high temperature and to understand the strengthening mechanism as well as the good non-sag properties of fine tungsten filaments. Four such mechanisms have been found to be at work in the temperature interval investigated. These are: (a) inhibition of the grain boundary movement (e.g., inhibition of the recrystallization) up to very high temperatures; (b) the reasons of the sudden discontinuous and exaggerated grain-growth; (c) the mechanism of strengthening and (d) the non-sag mechanism. All four mechanisms depend upon the presence and the dispersion of bubbles containing the small amount of dope remaining in the wires. (auth)

12085 PHYSICOCHEMICAL PROPERTIES OF THE RARE EARTH MONOANTIMONIDES. Samsonov, G. V.; Abdusalyamova, M. N.; Shokirov, Kh.; Pryakhina, S. A. (Inst. of Problems in Materials Sciences, Kiev). Inorg. Mater.; 10: No. 11, 1672-1674 (Nov 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 11, 1951-1954(Nov 1974).

An investigation was made of the electrical conductivities, thermoelectric potentials, melting points, and microhardnesses of monoantimonides obtained by synthesis from the elements in capsules, and also their chemical stabilities in various reagents. All the monoantimonides are predominantly metallic, with some admixture of ionic bonding. (auth)

12086 MAGNETIC PROPERTIES OF CeSb. Bartholin, H. (Laboratoire de Magnetisme et Service National des Champs Intenses, Grenoble, France); Florence, D.; Tcheng-si, W.; Vogt, O. Phys. Status Solidi A.; 29: No. 1, 275-279(16 May 1975).

The magnetic properties of cerium antimonide single crystals were investigated as a function of high static magnetic fields up to 150 kOe and temperatures between 2 and 25 K. Like CeBi, CeSb exhibits a complicated magnetic phase diagram with step magnetization behavior. A remanent magnetization is observed at low temperature. (auth)

12087 CORRELATION BETWEEN THE ELECTRICAL RESISTIVITY AND MAGNETIC MOMENTS IN Fe_2A (A = Sc, Y, Zr, and Hf). Ikeda, K.; Nakamichi, T.; Shimizu, M.; Ono, S. (Tohoku Univ., Sendai). Phys. Status Solidi A.; 29: No. 1, K89-K91(16 May 1975).

The electrical resistivity of ferromagnetic Laves phase compounds, Fe_2A (A = Sc, Y, Zr, and Hf), was measured in order to investigate its mutual correlation with the magnetic moments. The results were interpreted on the assumption that the total resistivity can be expressed as the sum of the residual resistivity, due to lattice faults and impurity atoms, the phonon scattering contribution, proportional to T at high temperatures, and the magnetic scattering contribution, due to the thermal disordering of localized magnetic moments. (auth)

12088 HEAT CAPACITY OF THE URANIUM SESQUISELENIDE. Lagnier, R. (CEN, Grenoble, France); Suski, W.; Wojakowski, A. Phys. Status Solidi A.; 29: No. 1, K51-K54 (16 May 1975).

Lattice constants for U_2Se_3 were determined by x-ray diffraction, and the heat capacity of the compound was measured on a differential-type adiabatic calorimeter. The results of the latter measurements exhibit three anomalies, the first of which can be correlated to a magnetic transition. (auth)

12089 WETTING OF REFRACTORY METALS BY Al_2O_3–MgO MELTS. Elyutin, V. P.; Mitin, B. S.; Grits, E. F. (Moscow Inst. of Steel and Alloys). Inorg. Mater.; 10: No. 11, 1796-1797(Nov 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 11, 2093-2094(Nov 1974).

The contact angle of wetting was measured for aluminum oxide-magnesium oxide melts on substrates of tungsten, niobium, and molybdenum. The energy of adhesion was calculated from the surface tension, and values obtained were in the range 890–1120 MJ/m^2, with the minimum value being observed for about 20% MgO. (auth)

12090 EVALUATION OF A C–Cr–Mn–Ni–Si PRESSURE VESSEL STEEL USING FRACTURE MECHANICS AND C-SHAPED SPECIMENS. Prado, M. E.; Kuhn, B. A. (Univ. of California, Livermore). Int. J. Pressure Vessels Piping.; 3: No. 2, 137-148(Apr 1975).

The mechanical fracture toughness and subcritical crack growth properties of a C–Cr–Mn–Ni–Si pressure vessel steel were evaluated using a compact specimen and a C-shaped specimen. It was determined that the material characteristics were highly directional. The transverse properties were generally below the longitudinal and differed by a factor of five in the reduction in area and a factor of at least two in fracture toughness. The crack growth characteristics were determined from the power relationship $da/dn = A(K)^n$ and were found to have different rates in the three directions of the material. (auth)

12091 NATURE OF HIGH-TEMPERATURE SINKS FOR VACANCIES IN MOLYBDENUM AND TUNGSTEN. Mamalui, A. A.; Pervakov, V. A.; Khotkevich, V. I. (Kharkov State Univ.). Phys. Status Solidi A.; 29: No. 1, K21-K29(16 May 1975).

Thin wire samples of molybdenum and tungsten were annealed and quenched, and the variation of quenched-in resistance with grain structure and sample diameter was determined. The data indicated that the main defect sinks at high temperatures are grain boundaries and sample surfaces. (auth)

12092 HEXAGONAL-CLOSE-PACKED (hcp) CONFIGURATION OF ATOMS IN Ti–Nb ALLOYS WITH A NEAR ORDER OF DISPLACEMENT. Lyasotskii, I. V.; Tyapkin, Yu. D.; D'yakonova, N. B. (Inst. of Metal Science and Physics of Metals, Moscow). Dokl. Akad. Nauk SSSR; 220: No. 6, 1299-1302(21 Feb 1975). (In Russian).

A study of the diffuse scattering of electrons and x rays was carried out for a series of Ti–Nb (22 to 33 at % Nb) alloys containing additions of 3% Zr or 10% Al. Diffuse maxima in x ray reflections were detected indicating the presence of regions in the Ti–Nb alloys having a near order of hcp-like displacements. These displacements are characteristic for conversion of a bcc structure of an ω-phase to a distorted hcp structure. (SJR)

12093 INTERRELATIONSHIPS BETWEEN CREEP LIFE CRITERIA FOR FOUR NUCLEAR STRUCTURAL MATERIALS. Booker, M. K.; Sikka, V. K. (Oak Ridge National Lab., TN). Trans. Am. Nucl. Soc.; 21: 155-156(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12094 CARBON EFFECTS ON THE MICROSTRUCTURE AND TENSILE PROPERTIES OF 2¼ Cr–1 Mo STEEL WELDMENTS. Klueh, R. L.; Canonico, D. A. (Oak Ridge National Lab., TN). Trans. Am. Nucl. Soc.; 21: 157-158(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12095 REVIEW OF DYNAMIC TESTING TECHNIQUES AND MATERIAL BEHAVIOR. Lindholm, U. S. (Southwest Research Inst., San Antonio). pp 3-21 of Mechanical Properties at High Rates of Strain. New York; American Inst. of Physics (1974).

From conference on mechanical properties of materials at high rates of strain; Oxford, UK (2 Apr 1974). See CONF-740413-.

Recent developments in the characterization of inelastic deformation of materials are reviewed. After a general discussion of the development of the theoretical and experimental basis for describing strain rate effects, a number of specific examples illustrating material behavior under dynamic loading is presented. These are chosen to demonstrate the effect of rate of strain on yield inelastic flow and fracture in both brittle and ductile materials. Data are given for Mo and 6Al–4V Ti. (15 fig, 54 references) (auth)

12096 DEVELOPMENT OF MACROSCOPIC AND MICROSCOPIC THEORIES OF HIGH VELOCITY DEFORMATION. Kawata, K. (Tokyo Univ.); Kuriyama, S. pp 215-223 of Mechanical Properties at High Rates of Strain. New York; American Inst. of Physics (1974).

From conference on mechanical properties of materials at high rates of strain; Oxford, UK (2 Apr 1974). See CONF-740413-.

The development of macroscopic and microscopic theories of high-velocity deformation of metals is reviewed, with emphasis on high velocity tension of thin bars. The following work is presented: (1) The theoretical relationship of breaking elongation epsilon/sub b/ of thin bars of finite length made of materials with various stress–strain characteristics to tensile velocity V_1 under high velocity tension, based upon the strain rate independent theory. (2) The effect of crystal lattice systems on the relation of epsilon/sub b/ to V_1 observed in high-velocity tension tests of some pure metals and alloys and the discrepancies with the theoretical results based upon the strain rate independent theory. (3) The behavior, in high-velocity deformation, of thin bars of metal which is not explained consistently by macroscopic theories of high velocity deformation in metals is explained consistently by constructing constitutive equations based upon the mechanical equations of plastic flow of the Johnston–Gilman type. It is proper to use the Johnston–Gilman type of constitutive equations for the theory of stress wave propagation in mild steel. It seems that the form of the constitutive equations of other metals may bear a close resemblance to those of the Johnston–Gilman type. (auth)

12097 SHOCK WAVE PROPAGATION IN ANISOTROPIC SINGLE CRYSTALS. Gupta, Y. M. (Washington State Univ., Pullman). pp 249-250 of Mechanical Properties at High Rates of Strain. New York; American Inst. of Physics (1974).

From conference on mechanical properties of materials at high rates of strain; Oxford, UK (2 Apr 1974). See CONF-740413-.

Stress relaxation in anisotropic single crystals (W, Ta, Be, etc.) is discussed. Shock propagation along the [100] direction in LiF single crystals was analyzed in more detail to determine the micromechanism. Dislocation generation by heterogeneous nucleation is suggested. (DLC)

12098 SOME POSSIBLE CRITERIA FOR INCIPIENT SCABBING OF Be. Lambourn, B. D. (Atomic Weapons Research Establishment, Aldermaston, Eng.). pp 262-271 of Mechanical Properties at High Rates of Strain. New York; American Inst. of Physics (1974).

From conference on mechanical properties of materials at high rates of strain; Oxford, UK (2 Apr 1974). See CONF-740413-.

Incipient scabbing experiments on beryllium were analyzed using a one-dimensional, uniaxial strain, finite difference computer code which integrates the equations of motion using an elasto-plastic constitutive relation for the metal. It is shown that because of the marked difference between the elastic and plastic wave velocities in beryllium, due to its abnormally low Poisson's ratio, the peak tension is only about two-thirds of the peak compressive stress behind the plastic shock wave, and that the tension–time history at the plane that scabs is more triangular than square. The calculations are used to examine various possible criteria for incipient scabbing, including critical values for the integrals of various functions of the tension with time. Several possible criteria fit the experimental results, but the criteria that fit depend on the assumptions made for the constitutive relation of Be in the calculations. (auth)

12099 CONFLICTING DEDUCTIONS FROM MACHINING AND OTHER TESTS, CONCERNING FLOW STRESS AT HIGH STRAIN RATES AND TEMPERATURES. Childs, T. H. C. (Univ. of Bradford, Eng.). pp 382-392 of Mechanical Properties at High Rates of Strain. New York; American Inst. of Physics (1974).

From conference on mechanical properties of materials at high rates of strain; Oxford, UK (2 Apr 1974). See CONF-740413-.

This paper is concerned with the friction interaction between an En1A chip and a cemented tungsten–titanium carbide cutting tool during turning En1A on a lathe at speeds between 0.25 and 7.5 m s^{-1} and at feeds of 0.13 and 0.26 mm rev^{-1}. The mean friction stress has been measured and deductions made from chip shape measurements about the variation of the friction stress over the rake face. Three regimes of continuous chip formation were seen. In the first, the mean friction stress was independent of strain rate and temperature, in the second it depended on temperature and in the third, at the highest cutting speeds, it depended on temperature and feed. In the third regime, softening of the chip material caused by frictional heating limited the friction force, but the softening temperature depended on the heating rate of the chip material. Softening occurred at 700°C when the rate of heating from room temperature was 5.4×10^5 °C s^{-1} and at 1160°C when the rate was 1.7×10^7 °C s^{-1}. (auth)

12100 FAILURE OF STEEL STRUCTURES AND TESTS APPLIED TO EVALUATE POTENTIAL FOR FAILURE. (International Atomic Energy Agency, Vienna). pp 53-78 of Neutron Irradiation Embrittlement of Reactor Pressure Vessel Steels. Steele, L. E. Vienna; International Atomic Energy Agency (1975). See STI/DOC–10/163.

Metal failure by a fast running crack (brittle fracture) may be catastrophic. This chapter evaluates laboratory test procedures which may help to project conditions required for such failure and thereby aid in developing interpretative procedures for avoiding such failure. Emphasis is placed on standard test procedures, but newly developed tests are also reviewed. (17 fig, 37 references) (DLC)

12101 ENVIRONMENT-DEPENDENCE OF THE MECHANICAL PROPERTIES OF METALS AT HIGH TEMPERATURE. Cook, R. H.; Skeleton, R. P. (Central Electricity Research Labs., Leatherhead). Int. Metall. Rev.; 19: 199-222(Dec 1974).

Published work on the effect of the environment on mechanical properties of metals at elevated temperatures is reviewed. The possible reactions which occur between a metal and its environment are first described. The effect of various environments including air, He, CO_2, and of flowing Na are examined for N_2 and Ni-based alloys, austenitic steels, ferritic steels, and other materials. High-frequency and low-frequency fatigue behaviour, mainly based on total endurance tests, is examined in a number of environments He, CO_2, and Na, for steels, nickel alloys, and Magnox A180. The effect of trace impurities on crack propagation and the mechanism of fatigue crack growth is examined. Finally, the effect of bulk oxide on mechanical properties is discussed. (174 references.) (UK)

12102 DEFECTS INDUCED BY THERMAL FATIGUE: MICROSCOPICAL OBSERVATIONS ON Zn AND Cd TREATED BY LOW TEMPERATURE THERMAL CYCLING. Levi, F. A. (Univ., Perugia, Italy). Metall. Ital.; 67: No. 2, 65-70(Feb 1975). (In Italian).

Microscopic observations are described of polycrystalline platelets of pure Zn and Cd, exposed to thermal cycling between room temperature and 87°K. The existance of thermal fatigue is confirmed in both cases. The behavior of the two metals is however very different: Cadmium shows mainly plastic deformation, while basal cleavage is very frequent in zinc, where regular fracture is present, after many cycles, also outside basal planes. Propagation of cracks is also often observed in zinc, where cleavage and intergranular fracture are in many instances connected in long discontinuous lines through the specimen. The existance of several stages of deformation is evident in both metals. (auth)

12103 PROPERTIES OF SURFACE DIFFUSION PROCESSED V_3Ga TAPE. Hitotsuyanagi, H.; Moriyasu, T.; Nagata, M.; Matsuda, Y. (Sumitomo Electric Industries Ltd., Osaka). Cryogenics; 15: No. 4, 185-192(Apr 1975).

The rapid growth of superconducting magnet technology is leading to many applications of superconductivity in science and industry. At present, the most widely used practical superconductors are Nb–Ti alloys and Nb_3Sn compounds. Surface diffusion processed V_3Ga tape possesses an outstanding current carrying capacity in high magnetic fields. This paper is concerned with the properties of the V_3Ga tape which is produced on a commercial scale. (auth)

12104 HEAT FORMATION OF PRASEODYMIUM-BISMUTH ALLOYS. Borsese, A.; Ferro, R.; Capelli, R.; Delfino, S. (Fenwal Electronics, Inc., Farmingham, MA). Thermochim. Acta.; 11: No. 2, 205-210(Feb 1975).

In the Pr–Bi system, heats of formation were measured using a direct isoperibol calorimeter. The composition and equilibrium state of the samples were checked by chemical, metallographic, and x-ray analyses. The following values were found for the two known compounds (reaction in the solid state, 300°K): PrBi, $\Delta H = -23.9 \pm 0.5$ kcal/g-at. Pr_4Bi_3, $\Delta H = -22.4 \pm 0.5$ kcal/g-at. Results are compared with those in other RE–Bi systems and briefly discussed. (INIS)

12105 STRUCTURE OF CONTINUOUS HAFNIUM DEPOSITS OBTAINED BY ELECTROLYSIS OF A CHLORIDE MELT. Martem'yanova, Z. S.; Petenev, O. S.; Baraboshkin, A. N.; Ivanovskii, L. E. Tr. Inst. Elektrokhim., Ural. Nauch. Tsentr. Akad. Nauk SSSR; No. 21, 53-55(1974). (In Russian).

Continuous hafnium deposits, electrodeposited from a melt of $NaCl-KCl-HfCl_4$ at 750 to 800°C, have a columnar structure which is manifested by metallographic studies. The axis of the texture of the deposit is $[11\bar{2}0]$. The surface of the deposit at 800°C is formed by facets of the family $\{10\bar{1}0\}$, and at 750°C by planes of the families $\{10\bar{1}0\}$ and $\{10\bar{1}1\}$. (SJR)

12106 STRUCTURE OF CONTINUOUS DEPOSITS OF TUNGSTEN OBTAINED BY ELECTROLYZING A $Na_2WO_4-WO_3$ MELT. Baraboshkin, A. N.; Martem'yanova, Z. S.; Shunailov, A. F.; Ksenofontova, T. B.; Zavorokhin, L. N. Tr. Inst. Elektrokhim., Ural. Nauch. Tsentr. Akad. Nauk SSSR; No. 21, 66-71(1974). (In Russian).

A study is made of the structure of continuous deposits of tungsten obtained by electrolyzing a melted mixture of sodium tungstate and tungsten trioxide. It is shown that at temperatures of 815 to 900°C and current densities of 0.01 to 0.1 A/cm^2 in an open bath it was possible to obtain deposits on copper, nickel, graphite, molybdenum, and tungsten. The structure of the deposits is determined to a significant degree by the structure of the backing. (SJR)

12107 INFLUENCE OF THE ANISOTROPIES OF THE ELECTRON–PHOTON SYSTEM ON CUBIC TYPE-II SUPERCONDUCTORS NEAR T_c. Teichler, V. H. (Univ., Stuttgart). Philos. Mag.; 31: No. 4, 775-788(Apr 1975). (In German).

For cubic superconductors, transport-like equations are presented which take fully into account the microscopic anisotropies of the coupled electron-phonon system. In the limiting case of temperatures near T_c, these equations are used to construct an anisotropic generalization of the free energy functional of Neumann and Tewardt (Neumann, L. and Tewordt, L., 1966, Z. Phys., 189, 55). The anisotropic functional contains an additional new material or intermediate state of cubic superconductors. Values of this parameter are estimated for Nb, V, and Pb. (auth)

12108 ELECTRON WORK FUNCTION AND SURFACE TENSION OF BINARY ALLOYS IN THE GALIUM–INDIUM AND GALLIUM–BISMUTH SYSTEMS. Khokonov, K. B.; Zadumkin, S. N.; Alchagirov, B. B. Elektrokhimiya; 10: No. 6, 911-916 (Jun 1974). (In Russian).

Measurements were carried out on the electron work function, surface tension and density of liquid Ga–In and Ga–Bi alloys over the entire interval of compositions and region of temperatures from liquidus temperatures to 500°C. Polytherms of the density of the pure metals and of all the alloys under investigation are represented by straight lines. Polytherms of the surface tension of a number of alloys and isotherms of the surface tension for both systems are presented. The following values were obtained for the electron work function ϕ: for pure Ga at 200°C $\phi = 4.35 \pm 0.05$ eV; for In $\phi = 4.08 \pm 0.04$ eV, and for Bi at 300°C $\phi = 4.34 \pm 0.05$ eV. (tr-SJR)

12109 $L\beta_2$ VALENCE BAND SPECTRUM OF NIOBIUM IN THE METAL AND IN THE α,β TWO-PHASE REGION OF THE Nb–H SYSTEM. Gilberg, E. (Univ., Munich). Phys. Status Solidi B.; 69: No. 2, 477-481(1 Jun 1975).

The $L\beta_2$ valence band spectrum of niobium in the metal and in the α,β two-phase region of the Nb–H system was investigated using a high resolution bent crystal spectrograph with photoelectric registration. The spectrum was excited in fluorescence. The atomic ratio [H]/[Nb] varied between 0.45 and 0.70. The spectrum of the niobium metal has the shape of an asymmetric line with long tailing on the low energy side. In the Nb–H system, a new emission band arises within the low energy tailing. In addition, the line is slightly shifted towards higher energies. It is suggested that the new emission band is due to transitions from an energy band which is responsible for the Nb–H bonding. (auth)

12110 EFFECT OF PRESSING ON TEXTURE IN PRESS-MAGNETS OF THE ALLOY $SmCo_5$ POWDER. Povolotskii, E. G.; Bogatin, Ya. G.; Surov, Yu. I. (Saratov Polytechnical Inst., USSR). Porosh. Met., Akad. Nauk Ukr. SSR; No. 2, 25-28(Feb 1975). (In Russian).

The effect was studied of the pressing process of the alloy $SmCo_5$ powder given a preliminary texture in a magnetic field on perfection of texture in pressed-magnets. By means of statistical and metallographic methods, the powder particles were shown to be destroyed and disoriented regularly during pressing; this is one of the main causes of the texture deterioration in the pressed parts. (auth)

12111 CRYSTAL STRUCTURE OF V_8Ga_{41}. Girgis, K.; Petter, W.; Pupp, G. (Eidgenossische Technische Hochschule, Zurich). Acta Crystallogr., Sect. B; 31: No. 1, 113-116(15 Jan 1975).

The structure of V_8Ga_{41} has been determined by trial-and-error methods. In the space group R3 a rhombohedral unit cell with $a = 9.456$ Å, $\alpha = 94.958°$, contains one $Ga(VGa_3)_8$ formula unit. One Ga is in the center of a cuboctahedron of Ga atoms, whose triangular faces are each shared by a face of a $[VGa_{10}]$ polyhedron. This $[VGa_{10}]$ polyhedron is formed by ten triangular and three almost-square faces and can be described as consisting of half an icosahedron and half a cube. The structure has been refined anisotropically with 2457 unique reflexions to $R = 0.044$. (auth)

12112 Mo_8Ga_{41}: ANOTHER EXAMPLE OF TEN-COORDINATION OF THE TRANSITION ELEMENT. Yvon, K. (Univ., Geneva). Acta Crystallogr., Sect. B; 31: No. 1, 117-120(15 Jan 1975).

Mo_8Ga_{41} is rhombohedral, space group $R\bar{3}$, with $a_{hex} = 14.04$ (1), $c_{hex} = 15.05$ (1) Å, $Z = 1$, $D_x = 6.95$ g cm^{-3}. R for 1000 reflexions is 0.09. The structure is isotypic with V_8Ga_{41} and bears a strong resemblance to Mo_6Ga_{31}. The Mo atoms are tenfold coordinated by Ga, most of the Mo–Ga distances being very short. No Mo–Mo contacts exist and no Ga–Ga pairing is observed. The structure may be derived by stacking $[MoGa_{10}]$ polyhedra and centred Ga cuboctahedra. This arrangement results in layers of Ga atoms and rumpled chains of alternating Mo and Ga atoms. (auth)

12113 CHARACTERISTICS OF A SERIES OF Nb–Zr ALLOYS AS SUPPORT FOR THE SUPERCONDUCTING INTERMETALLIC COMPOUND Nb_3Sn. Donolato, C.; Olzi, E.; Ortali, P. L.; Strocchi, P. M. (CNR, Milan). Metall. Ital.; 67: No. 5, 258-262(May 1975). (In Italian).

Use of Nb–Zr alloys as support for Nb_3–Sn-base superconducting materials improves the current carrying capacity of the intermetallic compound. In order to clarify the correlations among Zr-content, dislocations density, and critical current, a series of alloys with a Zr-content ranging from 1 to 7% and different rates of cold-work, was reacted with molten tin. Chemical analysis of Zr and impurities as well as metallography, microhardness tests and an evaluation of dislocations density were performed. (auth)

12114 LOW TEMPERATURE DISLOCATION INTERNAL FRICTION PEAKS IN TANTALUM. Knoblauch, G.; Benoit, W.;

Schultz, H. (Max-Planck-Institut fuer Metallforschung, Stuttgart). Scr. Metall.; 9: No. 6, 657-662(Jun 1975).

Internal friction damping measurements were made for high-purity and nitrogen-doped tantalum single crystals in ultrahigh vacuum from 10 K to 360 K. The peak position for the high purity sample depends greatly on sample orientation (220-270 K), resulting in different frequency factors. The value for the activation energy appears independent of the purity, crystal orientation, deformation temperature, and degree of deformation, but the frequency factor depends on all these parameters. The results show that the effect of impurities is to reduce peak heights and to shift the peaks to lower temperatures. A low temperature damping peak at 150 K is observed, particularly after low temperature deformation. This peak is probably related to the thermally activated motion of geometrical kinks in screw dislocations. The alpha peak shows the typical properties of a Bordoni peak, due to the formation of double kinks in non-screw dislocations. (PMA)

12115 H-H-ATOM INTERACTIONS IN THE GROUP V METALS. McLellan, R. B. (Rice Univ., Houston, TX). Scr. Metall.; 9: No. 6, 681-685(Jun 1975).

Using experimental data for enthalpies of solution, thermal expansion coefficients, and bulk moduli for the V–H, Nb–H, and Ta–H systems, a calculation was made for the mutual interaction between H-atoms dissolved in the metal lattices. Qualitatively, the H-H interaction appears to be very weak and slightly attractive, although the latter conclusion depends on a rather large extrapolation of the elastic data. (PMA)

12116 EFFECT OF HYDROGEN ON THE STRENGTH MODULUS AND LATTICE PARAMETER OF A Ti–Mo ALLOY. Paton, N. E.; Buck, O.; Williams, J. C. (Rockwell International, Thousand Oaks, CA). Scr. Metall.; 9: No. 6, 687-691(Jun 1975).

The effect of hydrogen on the strength, Young's modulus, and lattice parameter of a bcc Ti–18 wt percent Mo alloy was investigated. Hydrogen in solid solution was found to increase the lattice parameter and decrease the strength and Young's modulus of the alloy. The implications of these results are discussed. (auth)

12117 EFFECT OF HELIUM ENVIRONMENT ON THE CREEP RUPTURE PROPERTIES OF INCONEL 617 AT 1000°C. Hosoi, Y.; Abe, S. (Nippon Steel Corp., Kawasaki, Japan). Metall. Trans., A; 6: No. 6, 1171-1178(Jun 1975).

The effect of oxygen contents in helium and in vacuum on the creep rupture properties of Inconel 617 has been investigated at 1000°C under the stress of 3,5 kg/mm^2. The main results are as follows. 1) The creep rupture properties in 99,9999 and 99,995 percent helium and in high vacuum are almost the same as those in air. 2) The oxygen in helium causes a remarkable decrease of the creep rupture time and similar effect of oxygen is also found in the controlled pressure of air. 3) The effect of oxygen on the creep rupture properties is attributable to the decarburization which tends to decrease the high temperature strength. (auth)

12118 CONCERNING THE STRENGTH OF DYNAMIC STRAIN AGING IN ZIRCONIUM. Garde, A. M.; Aigeltinger, E.; Woodruff, B. N.; Reed-Hill, R. E. (Univ. of Florida, Gainesville). Contract AT(40-1)-3262. Metall. Trans., A; 6: No. 6, 1183-1188 (Jun 1975).

Tensile tests on high purity (6×10^{-4} oxygen equivalent) and commercial purity (6×10^{-3} oxygen equivalent) zirconium were performed between 77 and 1000°K in order to evaluate dynamic strain aging (DSA). A comparison with earlier data from two equivalent titanium compositions yielded the following; reducing the interstitial concentration to the zone refined iodide level removes most evidence of strain aging in both zirconium and titanium. At this impurity concentration, zirconium also shows a greatly reduced thermally activated flow stress component. This was not observed in titanium. At the commercial purity level, both metals exhibit strain aging phenomena. These are much weaker, however, in Zr than in Ti. Even at this impurity level Zr does not exhibit a strain aging yield point, the Portevin-Le Chatelier effect or a well defined work hardening rate peak. All of these latter are found in commercial purity Ti. Several other aspects of DSA, while observed in Zr, are less pronounced than in Ti. The principal interstitial impurity in these materials is oxygen. Oxygen in solid solution strongly increases the (c/a) ratio of Ti, but has little effect on this ratio in Zr. This distortion of the Ti hcp lattice may account, in part, for the greater strength of DSA in this metal. (auth)

12119 PRISMATIC SLIP IN ZIRCONIUM SINGLE CRYSTALS AT ELEVATED TEMPERATURES. Akhtar, A. (Univ. of British Columbia, Vancouver). Metall. Trans., A; 6: No. 6, 1217-1222 (Jun 1975).

Single crystals of Zr oriented favorably for prismatic slip have been deformed in tension over a range of strain rates at temperatures between 473 and 1113°K. A temperature independent plateau is observed between 600 and 800°K and dynamic strain aging occurs in the vicinity of 723°K. The flow stress is temperature dependent both above and below this temperature interval. Plastic flow above 850°K is represented by an equation of the form: gamma equals Atau/sup n/e/sup- Q/kT/ where gamma is the shear strain rate, A is a constant whose value is 680 +- 20 (MN/m^2)/sup - 4,3/. The stress exponent n equals 4,3 +- 0,3 and the activation energy Q equals 2,05 +- 0,15 eV. It is proposed that the high temperature prismatic slip in Zr is controlled by a glide-climb process where the rate of plastic flow is determined by the rate of climb of dislocations. (auth)

12120 ATOMIC MOBILITIES AND VACANCY WIND EFFECTS FOR DIFFUSION IN TERNARY SILVER–ZINC–CADMIUM SOLID SOLUTIONS. Carlson, P. T. (Oak Ridge National Lab., TN); Dayananda, M. A.; Grace, R. E. Contract AT(11-1)-1436. Metall. Trans., A; 6: No. 6, 1245-1252(Jun 1975).

Diffusion in the silver-zinc-cadmium system was investigated at 600°C with semiinfinite, vapor-solid couples in order to determine the atomic mobilities and contribution of the vacancy wind effect to the intrinsic diffusion fluxes of silver, zinc, and cadmium in the alpha phase region. Atomic mobilities and vacancy wind parameters were computed at selected compositions in the alpha phase along isoconcentration lines of 11 at. percent Zn, 18 at. percent Zn, 5 at. percent Cd and 9 at. percent Cd. The existence of significant interactions between the diffusing species was indicated by the results of an earlier investigation; consequently, the vacancy wind effect was taken into consideration in the calculation of the mobilities. The mobilities of zinc and cadmium, determined by the method of Dayananda, were found to increase with increasing zinc and cadmium concentrations with the mobility of zinc being greater than that of cadmium. The results of the investigation show that the vacancy wind effect significantly affects the total intrinsic flux of each of the three species for diffusion in ternary silver-zinc-cadmium alloys. This investigation reports the experimental observation of the vacancy wind effect in a ternary system. (auth)

12121 STRAIN-AGING OF VANADIUM, NIOBIUM, OR TITANIUM-STRENGTHENED HIGH-STRENGTH LOW-ALLOY STEELS. Rashid, M. S. (General Motors Research Labs., Warren, MI). Metall. Trans., A; 6: No. 6, 1265-1268(Jun 1975).

Four commercially available high-strength low-alloy (HSLA) steels were evaluated. It was determined that all four steels were susceptible to strain-aging by interstitial solutes. The increase in strength due to strain-aging was similar to that observed in a low carbon steel studied for comparison. At high levels of prestrain, the percent loss in ductility in the HSLA steels was comparable to that observed in the low-carbon steel in specimens prestrained to the same fraction of the total elongation of the as-received metal. However, when considered on an absolute basis, the residual ductility in the HSLA steels was lower than that observed in the low-carbon steel. The kinetics of strain-aging were briefly examined. Indications are that the kinetics are slower in the HSLA steels than they are in the low-carbon steel. (auth)

12122 STRUCTURE AND ELEVATED TEMPERATURE PROPERTIES OF CARBON-FREE FERRITIC ALLOYS STRENGTHENED BY A LAVES PHASE. Dilip Bhandarkar, M.; Shanthidas Bhat, M.; Zackay, V. F.; Parker, E. R. (Lawrence Berkeley Lab., CA). Metall. Trans., A; 6: No. 6, 1281-1289(Jun 1975).

A Laves phase, Fe_2Ta, was utilized to obtain good elevated temperature profiles in a carbon-free iron alloy containing 1 at. percent Ta and 7 at. percent Cr. Room temperature embrittlement resulting from the precipitation of the Laves phase at grain boundaries was overcome by spheroidizing the precipitate. This was accomplished by thermally cycling the alloys through the alpha yields gamma transformation. The short-time yield strength of the alloys decreased very slowly with increase in test temperature up to 600°C, but above this temperature, the strength decreased rapidly. Results of constant load creep and stress rupture tests conducted at several temperatures and stresses indicated that the rupture and creep strengths of spheroidized 1 Ta–7 Cr alloy were higher than those of several commercial steels containing chromium and/or molybdenum carbides but lower than those of steels containing substantial amounts of tungsten and vanadium. When molybdenum was added to the base Fe–Ta–Cr alloy, the rupture and creep strengths were considerably increased. (auth))

12123 DISCUSSION OF "RELATIONSHIP BETWEEN DEFORMATION TWINNING AND THE STRESS-STRAIN BEHAVIOR OF POLYCRYSTALLINE TITANIUM AND ZIRCONIUM AT 77°K". Keshavan, M. K.; Sargent, G.; Conrad, H. (Univ. of Kentucky, Lexington). Metall. Trans., A; 6: No. 6, 1291-1292.

The effects of twinning on work hardening of Ti and Zr were

studied. In these studies the effects due to slip (glide dislocations) were separated from those due to twinning. It was found that although twinning may have some influence on the absolute values of the work hardening rate in Ti and Zr, it is not the primary factor responsible for the distinct stages in Crussard–Jaoul (C-J) plots. Rather, it appears that these stages are due to changes in slip or glide dislocation structure or behavior. The nature of these changes is not clear. (JRD)

12124 PRECIPITATION AND COARSENING OF BETA-Ni_4Mo IN NICKEL-23.4 AND 25.8 WT PERCENT MOLYBDENUM ALLOYS. Spruiell, J. E. (Univ. of Tennessee, Knoxville); Ruch, L. M.; Brooks, C. R. Metall. Trans., A; 6: No. 6, 1301-1305 (Jun 1975).

Characteristics of the microstructure, precipitation behavior, and properties of alloys on the Ni-rich side of the Ni_4Mo system in the two-phase alpha plus beta region of the equilibrium diagram are described. (JRD)

12125 SLIP-INDUCED CRACKING IN Mo SINGLE CRYSTALS. Carpay, F. M. A.; Mahajan, S.; Chin, G. Y.; Rubin, J. J. (Bell Labs., Murray Hill, NJ). Scr. Metall.; 9: No. 5, 451-457(May 1975).

The room-temperature cracking behavior of Mo single crystals deformed in (011) [100] plane strain compression was studied. It was found that the initiation of slip-induced cracks in molybdenum single crystals, deformed in this manner may be explained on the basis of Cottrell's model for crack nucleation. Further, the fracture process in this material appears to be controlled by crack propagation. (JRD)

12126 DISCONTINUITIES AT THE ELASTIC LIMIT IN AN ORDERED Fe–Co–V ALLOY. Eymery, J. P.; Moine, P. (CNRS, Poitiers, France). Scr. Metall.; 9: No. 5, 467-473(May 1975). (In French).

The existence of discontinuities at the elastic limit observed during traction tests on an Fe–Co–V alloy with B2-type order and with the composition 48.22 wt. percent Fe, 48.96 wt. percent Co, and 2.07 wt. percent V was reported. Studies on the effect of the order showed that the appearance of the order involves the existence of discontinuities at the elastic limit. These discontinuities are only slightly dependent on the test temperature and the traction rate. The results are discussed within the framework of the Hahn model for the appearance of discontinuities. (JSR)

12127 EFFECT OF MICROSTRUCTURE ON GRAIN BOUNDARY SEGREGATION OF P IN A Cr–Mo–V STEEL. Viswanathan, R. (Westinghouse Research Labs., Pittsburgh); Joshi, A. Scr. Metall.; 9: No. 5, 475-478(May 1975).

Bainitic and martensitic structures tempered to different strength levels were produced in a Cr–Mo–V steel and the effect of the associated microstructural changes on the grain boundary segregation of impurities was determined by Auger spectrometry. Results show that the ratio of grain boundary concentration to that in the bulk is larger for Sn impurities than for P in Ni–Cr–Mo–V steels. It appears, therefore, that the smaller segregation of Sn observed in the study can be explained in terms of slower diffusion rates of Sn compared with P in the alpha-Fe lattice. (JRD)

12128 SURFACE OXIDE SOFTENING OF Nb AND Ta SINGLE CRYSTALS. Sethi, V. K.; Gibala, R. (Case Western Reserve Univ., Cleveland). Scr. Metall.; 9: No. 5, 527-532(May 1975).

High purity single crystals of Nb and Ta, with a 2.6 mm diameter, a 13 mm gage length, and the tensile axis oriented near the center of the stereographic triangle, were prepared by electron beam zone melting at a pressure of approximately 10^{-5} torr followed by solid state outgassing under ultra-high vacuum (approximately 10^{-10} torr) at temperatures above 2600°K for Nb and 3000°K for Ta. Room temperature to 4.2°K resistivity ratios of 1850 ± 100 for Nb and 2600 ± 200 for Ta were obtained, suggesting residual concentrations of interstitial solutes below approximately 10 at. ppM. The results are given in the form of stress-strain curves at 77°K for Nb and Ta crystals. The magnitude of the yield stress and the flow behavior of the as-outgassed crystals are about the same as observed by several investigators on materials purified in similar ways. Prestraining Nb 9.5 percent at 300°K and Ta 6 percent at 450°K reduces the stress level for plastic flow in both materials, but the effect is small compared with the effects of oxide coatings. (JRD)

12129 INVESTIGATIONS ON THE SYSTEM NIOBIUM–HYDROGEN. Ableiter, M.; Gonser, U. (Universitaet des Saarlandes, Saarbruecken (F. R. Germany). Fachbereich Angewandte Physik). Z. Metallkd.; 66: No. 2, 86-92(1975). (In German).

The system niobium–hydrogen was investigated by means of electrical resistivity, Hall-Effect and Moessbauer spectroscopy. The results give information concerning the electronic structure of this system and allow extension of the phase diagram. Furthermore, indications are found that a magnetic moment is induced by hydrogen in Fe-atoms dispersed in the niobium matrix. (GE)

12130 HYPERFINE INTERACTIONS AND RELAXATION EFFECTS OF Er IMPURITIES IN Y STUDIED BY MOESSBAUER SPECTROSCOPY. Stoehr, J.; Wagner, W. (Technische Univ., Munich). J. Phys., F (London).; 5: No. 4, 812-821(Apr 1975).

Moessbauer spectra of ^{166}Er impurities in the hcp metal Y were measured between 1.4 and 10°K. The figure obtained is A = (260 ± 3)MHz for the magnetic hyperfine coupling constant. This value is larger than the value found for insulator hosts due to conduction electrons polarized by the 4f impurity spin. Recently published electronic wavefunctions for Er in Y are used to separate the two contributions to the electric field gradient $(1 + R'_Q)\, eq_{4f} = (-1.2 \pm 0.1) \times 10^{18}$ V cm^{-2} and $(1 - \gamma'_\infty)(1 + \delta_2)\, eq_{latt} = 5.5 \times 10^{17}$ V cm^{-2}. The latter value can be well accounted for by the known CEF parameter B_2^0 for dilute Y: Er alloys and the radial integral $\langle r^2 \rangle_{4f}$ and the shielding parameters γ'_∞ and σ'_2 derived previously for the heavy rare earth metals. From the temperature dependence of the Moessbauer relaxation spectra, $|J_{sf}| = 4.6 \times 10^{-2}$ eV is derived for the exchange coupling constant. (auth)

12131 CALIFORNIUM METAL. Zachariasen, W. H. (Univ. of Chicago). J. Inorg. Nucl. Chem.; 37: No. 6, 1441-1442(Jun 1975).

It is shown that the two phases described by Haire and Baybarz (J. Inorg. Nucl. Chem.; 36: 1295 (1974)) as two forms of californium metal are compounds of californium. The hexagonal phase is found to be Cf_2O_2S from a detailed analysis of the published diffraction data, and the fcc phase is identified as CfS. In both compounds the metallic valence of californium is three with a metallic radius of 1.83 to 1.85 Å. (auth)

12132 DISCONTINUOUS TRANSITION IN Yb AND Eu ATOMIC VOLUME AS A FUNCTION OF THE GRAIN SIZE. Bonnelle, C.; Vergand, F. (Univ., Paris). J. Phys. Chem. Solids; 36: No. 6, 575-577(Jun 1975).

A discontinuous variation in the interatomic distances of the two divalent rare earths, Eu and Yb, was observed as a function of grain size. In the case of Yb it is shown that this is accompanied by a modification in the numbers of f electrons. Results are discussed with respect to those obtained at high pressures and the various perturbations which may occur in grains of small volume are invoked. (auth)

12133 MICROWAVE RESONANCE AND MAGNETIZATION IN Tb: 25% Gd. Bagguley, D. M. S.; Partington, J. P. (Oxford Univ.). J. Phys., F (London).; 5: No. 4, L39-L41(Apr 1975).

Microwave resonance and magnetization were investigated in Tb–25 at.% Gd single crystal discs. There is a first-order paramagnetic-ferromagnetic phase change at 244°K. A Tb–32 at.% Gd crystal has a first-order phase change at 253°K. (auth)

12134 HEAT CAPACITY OF Th AND Th_4H_{15} IN THE TEMPERATURE RANGE ABOVE 2K. Schmidt, H. G.; Wolf, G. (Bergakademie, Freiburg i. B.). Solid State Commun.; 16: No. 9, 1085-1087(1 May 1975).

Heat capacity C of pure Th and Th_4H_{15} was measured in the temperature range above 2°K. In the case of Th_4H_{15}, the superconducting anomaly was observed in the temperature slope of C at T = 7.6°K. For Th_4H_{15}, the γ-coefficient of electronic heat capacity is smaller and the Debye temperature larger than that of pure Th, respectively. (auth)

12135 EFFECT OF SAND BLASTING ON THE LOW CYCLE FATIGUE OF TITANIUM ALLOYS. Strizhalo, V. A.; Zasimchuk, E. E.; Morozov, B. S.; Bega, N. D.; Kuzema, Yu. A.; Il'in, A. A. (Inst. of Strength Problems, Kiev). Strength Mater.; 6: No. 9, 1083-1086(Sep 1974).

Translated from Probl. Prochnosti; No. 9, 43-47(Sep 1974).

A study was made of the low-cycle fatigue properties of titanium alloys, VT5-1, VT6S, and VT14, subjected to a pulsating tensile stress. Both smooth samples and samples subjected to sand blasting were tested. The results show that sand blasting greatly reduces the strength and fatigue life of the titanium alloys, but has very little effect on the ductility. (GE)

12136 INFLUENCE OF A PLANE STRESS SATE AND STRESS CONCENTRATION ON THE STRENGTH AND PLASTICITY PROPERTIES OF TITANIUM ALLOYS AT LOW TEMPERATURES. Savva, S. P.; Il'ichev, V. Ya. (FTINT, Kharkov). Strength Mater.; 6: No. 9, 1101-1103(Sep 1974).

Translated from Probl. Prochnosti; No. 9, 61-63(Sep 1974).

A study was made of the strength and plastic properties of titanium alloys, AT2, VT5-1kt, and VT14, at low temperatures. The influence of stress concentration, in the form of circular

holes, and the temperature dependence of the strength and the coefficient of sensitivity to stress concentration were determined. (auth)

12137 ACOUSTIC EMISSION STUDY DURING PROGRAMMED LOADING. Vainberg, V. E. Strength Mater.; 6: No. 9, 1157-1158(Sep 1974).

Translated from Probl. Prochnosti; No. 9, 117-118(Sep 1974).

The Keiser effect, the irreversibility of acoustic ultrasonic emission from materials during deformation, was studied in steel, aluminum, copper, and niobium samples. The effect differed considerably from the universal form in the copper and nobium samples, and it was concluded that acoustic emission can provide new information on deformation mechanisms and that more careful studies are required. (auth)

12138 LOW VISCOSITY COEFFICIENT MAGNETIC AFTER-EFFECT IN NICKEL AND IN $SmCo_5$. Hahn, A.; Paulus, M.; Steigenberger, N.; Stierstadt, K. (Univ., Bochum). Int. J. Magn.; 6: No. 2, 167-171(1974).

A previous theoretical investigation of the temperature-dependent magnetic viscosity coefficient $S_v(T)$ is summarized and applied to a discussion of after-effect data on several materials. As an important result, a temperature-independent $S_v(T)$ in the limiting case of high temperature and low viscosity coefficient is observed in Ni and in $SmCo_5$, in accordance with the theoretical prediction. For other materials, $S_v(T)$-data on which are given in the literature, a discussion of the relevant parameters leads to the conclusion that the high viscosity coefficient limiting case applies, leading to a monotonically increasing $S_v(T)$. (auth)

12139 EFFECT OF TEXTURE ON THE MECHANICAL PROPERTIES OF WRe5 AND WRe10 ALLOYS. Geldner, E.; Schreiner, H. (Siemens AG, Nuerenberg, Ger.). High Temp.-High Pressures; 6: No. 4, 435-441(1974). (In German).

From 8th Plansee seminar; Reutte, Austria (27 May 1974).

Metallographic examinations and microprobe scans showed that rhenium distribution in WRe5 and WRe10 tungsten-rhenium alloys was inhomogeneous owing to unspecified manufacturing conditions. Tensile tests showed that rhenium concentration (5 or 10 wt %) had insignificant effect on the ultimate tensile strength of the alloys, but poor rhenium distribution, oxygen impurities in the form of oxides, and deformation during manufacture had a substantial effect on the tensile strength. Below the brittle-to-ductile transition temperature, the tensile strength depended on grain size; above this temperature, this dependence was much less pronounced. After 1 h exposure in vacuo to 2000°C, the grain size increased, the increase being dependent on the variation of the rhenium content from the nominal values of 5 or 10 wt % respectively, or the more the rhenium content exceeded the value of 10 wt %. (auth)

12140 COPPER IMPURITY IN DIFFUSION Nb_3Sn TAPES. Sharma, R. G.; Aleksivskii, N. E. (Inst. of Problems in Physics, Moscow). J. Phys., C (London); 8: No. 8, L129-L131(21 Apr 1975).

Nb_3Sn tapes are prepared by the method of diffusion under high vacuum. Tapes are also prepared under identical conditions with copper impurity (0.5 to 45 at.%) added into the tin. The critical current of the Nb_3Sn tapes, measured at 4.2°K and in a magnetic field of 30 kOe, is found to increase with copper impurity by a factor of as much as 2 for 1 for at.% copper. Further additions of copper, on the other hand, result in an almost logarithmic decrease of the critical current. The latter observation is in disagreement with the results reported earlier in the literature. (auth)

12141 APPLICATION OF THE MATRIX STUDY OF BURGERS TRANSFORMATION TO THE PRECIPITATION OF Ni-Mo COMPOUNDS IN MANAGING STEELS WITH 18% Ni. Mourey, M.; Bui, N.; Dabosi, F. (CNRS, Toulouse). Mater. Res. Bull.; 10: No. 6, 565-570(Jun 1975). (In French).

This paper concerns a geometrical analysis by coincidence lattice method of aging processes in maraging steels. It is shown an equal formation probability for NiMo and Ni_3Mo precipitates in this martensitic matrix. (auth)

12142 EFFECTS OF COBALT AND BORON ON THE MECHANICAL AND CORROSIVE PROPERTIES OF NICKEL FREE AUSTENITIC STAINLESS STEEL. Chun, B. S.; Kim, T. H. J. Korean Inst. Metals; 12: No. 4, 386-391(1974). (In Korean).

Four kinds of alloys, Fe-18% Mn-14% Cr-2% Co, Fe-18% Mn-14% Cr-4% Co, Fe-17% Mn-14% Cr-4% Ni, and Fe-17% Mn-14% Cr-2% Co-B, were prepared in air by means of a high frequency induction furnace. The mechanical and corrosive properties of these alloys were studied and compared with those of 18-8 stainless steel. It is concluded that the mechanical properties and corrosion resistance of the cobalt alloy increase when cobalt is replaced by boron; the two properties of the alloy can be improved as greatly as those of the alloys having cobalt alone. (Korean Sci. Abstr.)

12143 STRESS CORROSION CRACKING IN Ti-13V-11Cr-3Al ALLOY, FRACTURE CLASSIFICATION AND CRACKING MORPHOLOGY. Katz, Y.; Mathias, H. (Atomic Energy Commission, Beer-Sheva, Israel). pp 521-527 of Proceedings of the Fifth International Congress on Metallic Corrosion, Houston, TX; National Association of Corrosion Engineers (1974).

From 5th international congress on metallic corrosion meeting; Tokyo, Japan (21 May 1972). See CONF-720523-.

The micromechanical events which occur in stress corrosion cracking of Ti-13V-11Cr-3Al alloy were examined. A combined chemical and mechanical mechanism is proposed for the discontinuous cracking which allows for the relatively rapid crack propagation rates observed. The crystallographic cleavage found in the (100) planes emphasizes that the mechanical component in the phenomena is significant. The high concentration of hydrogen within the grain and in the matrix between product phases, as well as the transgranular mode of fracture support the hypothesis that a mechanism controlled by hydrogen entry is operating. It is believed that the hydrogen is more critical in terms of the embrittlement of the beta matrix than the initiation of the cleavage jump. The initiation stage is more related to the chemical reaction, while the crack step is dominated by the mechanical driving force. Although the stress intensity contribution might affect the triggering stage in a complex way (like the number of activated sites for the chemical reaction) the cleavage jump after triggering is directly affected in terms of larger jump distances due to the higher mechanical energy. (auth)

12144 TRITIUM ABSORPTION IN TYPE 304L STAINLESS STEEL. Louthan, M. R. Jr.; Donovan, J. A.; Caskey, G. R. Jr. (E. I. du Pont de Nemours and Co., Aiken, SC). Nucl. Technol.; 26: No. 2, 192-200(Jun 1975).

Tritium adsorption was determined in Type 304L austenitic stainless steel by analyzing concentration gradients obtained during prolonged exposures to high-pressure gaseous tritium. The calculated tritium diffusivities at temperatures greater than 373°K were shown to be in excellent agreement with the equation D equals (1/root m) (4.7×10^{-3}) exp(-12,900/RT) cm^2sec^{-2}, where m is the isotopic mass. This equation was previously developed for deuterium in several types of austenitic stainless steels. There was strong evidence for "short-circuit" diffusion paths and a grain size effect on tritium absorption. Such effects are assumed to cause the tritium diffusivities measured for exposures at less than 373°K to be higher than expected from the above equation. Cold work, either prior to or during exposure, significantly increased the effective tritium diffusivity. The increase in tritium diffusivity observed in the samples cold-worked prior to exposure is believed to be caused by preferential (short-circuit) diffusion through strain-induced martensite. The increase in diffusivity in specimens deformed during exposure is believed to be caused by enhanced tritium transport with moving dislocations. This analysis of concentration gradients also shows that tritium permeation rates through austenitic stainless steels will often be significantly less than rates expected from analysis of diffusion-controlled transport properties. This is because of surface barriers that limit tritium absorption, even at pressures to 69 MPa. Solubilities derived from analyses of the concentration gradients were consistently lower than expected and were significantly influenced by specimen surface conditions. (auth)

Radiation Effects

Refer also to abstracts 11592, 13046, 13052, 13064, 13122, and 13176.

12145 (AERE-TP-595) STRESS INDUCED POINT DEFECT-DISLOCATION INTERACTION AND ITS RELEVANCE TO IRRADIATION CREEP. Bullough, R.; Willis, J. R. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). 1974. 14p. Dep. NTIS (US Sales Only) $4.00.

The general interaction energy between an applied stress and a misfitting inhomogeneity is presented and used to deduce the accurate elastic interaction between edge dislocations and point defects in a body subjected to uniaxial tension. It is shown that the external stress does, as conjectured by Heald and Speight (1974), cause a preferential drift of interstitials and vacancies to dislocations with particular orientations to the external stress axis. Moreover, for a physically plausible range of the inhomogeneity representation of the point defects the particular preferences found are consistent with those necessary to validate the mechanism of irradiation creep proposed by Heald and Speight. (auth)

12146 (CEA-R-4670) CONTRIBUTION TO THE STUDY OF VOID FORMATION IN IRRADIATED METALS. Glowinski, L.

(CEA Centre d'Etudes Nucleaires de Saclay, 91 – Gif-sur-Yvette (France). Div. de Metallurgie et d'Etude des Combustibles Nucleaires). May 1975. 120p. (In French). Dep. NTIS (US Sales Only) $9.00.

Thesis. Submitted to Nancy Univ., France.

Void formation during 1-MeV electron irradiation or 500-keV copper ion irradiation in copper was studied. The defect production rates were similar for the two kinds of irradiation. Effects of dose rate, dose, temperature, and gas content of the sample were studied. It was found that gas atoms aid the nucleation of both voids and interstitial dislocation loops. The lower limit of the temperature range in which voids form is lower for electron irradiation than for ion irradiation. An increase in the dose rate shifts this lower limit towards higher temperatures for ion irradiation but leaves it unchanged for electron irradiation. The homogeneous nucleation models based on reaction rate theory do not predict these observations. A void nucleation mechanism is proposed. This model takes into account the fact that ion irradiation produces displacement cascades whereas electron irradiation does not. Vacancy clusters are already present in the cascades produced by heavy ions. These clusters can become void nuclei on the arrival of a gas atom. Without gas atoms the vacancy cluster either dissolves or becomes a vacancy loop. (auth)

12147 (DP-MS-75-7) SURFACE BLISTERING OF MATERIALS EXPOSED TO ^{242}Cm ALPHA RADIATIONS. McDonell, W. R.; Gould, T. H. Jr. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). 1975. Contract AT(07-2)-1. 22p. (CONF-750624-4). Dep. NTIS $4.25.

From American Nuclear Society meeting; New Orleans, Louisiana, USA (8 Jun 1975).

A study was conducted to establish the extent of surface deterioration of container materials for ^{242}Cm and ^{252}Cf caused by implantation of high concentrations of helium resulting from the alpha decay of the radionuclides. It was found that materials implanted with helium from alpha-emitting nuclide sources are much less susceptible to surface blistering at low temperatures than materials implanted with accelerator helium ions, probably because of a more uniform distribution of helium within the implanted surface layer. On postirradiation heating to high temperatures, however, a porous surface layer is formed. (auth)

12148 (FZK–379) HYDROGEN EMBRITTLEMENT OF IRRADIATED ALLOYS. Miles, J. K.; Burtnett, R. L. (General Dynamics Corp., Fort Worth, Tex. (USA). Convair Aerospace Div.). May 1971. Contract SNPC-73. 34p. Dep. NTIS $4.75.

The effects of gaseous hydrogen at 1500 psi and room temperature on the notch tensile strengths were determined for four alloys—301 SS, A-286, Ti-5Al-2.5Sn, and Inconel 718—which had been previously irradiated to neutron fluences of $1.3-1.6 \times 10^{20}$ n/cm^2 (E > 1 MeV). The reductions in notch tensile strength of 301 SS, 81%; Ti-5Al-2.5Sn, 7.3%; and A-286, unchanged, were in good agreement with those expected for similar specimens which were unirradiated. The notch tensile strength of irradiated Inconel 718 specimens was unaffected by hydrogen, while control specimens exhibited 8–9% losses in strength. (auth)

12149 (STI/DOC-10/163) NEUTRON IRRADIATION EMBRITTLEMENT OF REACTOR PRESSURE VESSEL STEELS. Steele, L. E. (International Atomic Energy Agency, Vienna (Austria)). 1975. 235p. IAEA $15.00.

This book is a review of present knowledge as a guide for the nonspecialist engineer involved in the development of nuclear power. Emphasis is on the portion of the primary system exposed to and affected by neutron radiation. The nature of reactors, of the steels used in their construction, and of the procedures for interpreting embrittlement and minimizing the effects are reviewed with reference to the reactors that are expected to play a major role in electric power production up to the year 2000. Separate abstracts were prepared for the first 8 chapters (the 9th and final chapter is a conclusion). (DLC)

For abstracts of individual chapters see: 11592, 11985, 12100, 12173–12175, 13021, and 13621.

12150 VOID SWELLING OF Nb AND Nb-1%Zr INDUCED BY ^{58}Ni$^+$ BOMBARDMENT. Loomis, B. A.; Taylor, A.; Gerber, S. B. (Argonne National Lab., Ill. (USA)). J. Nucl. Mater.; 56: No. 1, 25-37(Apr. 1975).

The void swelling of Nb and Nb–1 at % Zr alloy on ^{58}Ni$^+$ irradiation to approximately 50 atom displacements per atom at temperatures between 600 and 1150°C was determined. The void swelling, determined from transmission electron microscopy observations, shows a "double peak" in the temperature dependence of swelling. The existence of two swelling peaks was confirmed by step-height measurements on the irradiated specimens. The experimental results suggest that oxygen and nitrogen absorption during irradiation enhances the high-temperature swelling. It is shown that the calculated sink efficiencies for the observed irradiation-produced microstructural defects are consistent with the observed swelling peaks. (auth)

12151 INVESTIGATIONS ON IRRADIATED FISSION CHAMBER ELECTRODES. Boeck, H. (Atominstitut der Oesterreichischen Hochschulen, Vienna). J. Nucl. Mater.; 56: No. 1, 85-90(Apr 1975).

Analysis of some failed in-core fission chambers in a power reactor made a series of investigations on fission chamber electrodes necessary. Two types of electrodes with different uranium coating techniques were used. One type of electrodes was first exposed to maximum neutron doses of 2×10^{20} nvt at steady-state operation. Both were exposed to several reactor power pulses at the TRIGA reactor Vienna. Changes in the uranium layer on the electrode surface have been observed during steady-state operation depending on the neutron dose. Complete destruction of the uranium layer was observed after pulse irradiation with one electrode type, while the other electrode type remained in good condition. (auth)

12152 CONTRIBUTION TO THE STUDY OF "COTTRELL FLOW" GROWTH AND THE FLOW OF POLYCRYSTAL TEXTURES UNDER IRRADIATION. de Montpreville, C. T. (CEA Centre d'Etudes Nucleaires de Saclay, 91- Gif-sur-Yvette (France). Section de Recherches de Metallurgie Physique). J. Nucl. Mater.; 56: No. 1, 103-114(Apr 1975). (In French).

Expressions due to Anderson and Bishop for a statistically isotropic α-uranium polycrystal stressed in simple tension were generalized. Polycrystal grains possessing an arbitrary growth-rate tensor and with a texture possessing a 4-fold symmetry axis along which stress is applied are treated. The generalized expressions are also applied to zirconium polycrystals with idealized types of preferred orientation, and it is found that the rate of "Cottrell flow" is very sensitive to the texture and that the growth rate of polycrystals in a particular direction can be much greater than the arithmetic mean of the growth rates of the constituent grains in that direction. (auth)

12153 SIMULATION EXPERIMENTS TO STUDY THE DILATATION OF FAST BREEDER FUEL CLADDING BY FORMATION OF URANATES. Venker, H.; Ehrlich, K. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung). J. Nucl. Mater.; 56: No. 1, 115-120(Apr 1975).

Cladding dilatation of irradiated fuel pins near the fuel-blanket transition zone and strong Cs-peaks in γ-scanning curves indicated an accumulation of Cs resulting in a reaction with uranium oxide. Simulation experiments confirmed that formation of cesium uranate can cause a dilatation of the cladding. The possible influence of Ba, which may migrate via volatile parent products, has also been examined. Finally, simulation experiments were performed in order to examine whether formation of cesium uranate can be avoided by reducing the oxygen potential by means of uranium and niobium getters. (auth)

12154 AN EFFECT OF SOLUTE SEGREGATION ON VOID GROWTH IN IRRADIATED DILUTE ALLOYS. Brailsford, A. D. (Ford Motor Co., Dearborn, Mich. (USA)). J. Nucl. Mater.; 6: No. 1, 7-17(Apr 1975).

Void growth in an irradiated solid-solution or two-phase system can be inhibited if solute segregation near the void surface, induced, say, by a lowering of the surface free energy, simultaneously reduces the diffusion of vacancies relative to self-interstitials. The mechanism is found to be efficient in suppressing void growth when re-solution of second-phase precipitates leads to solute supersaturation, or impurity interstitials are generated by collision cascades in the matrix. While the effect does not require a precipitated second phase for the impurity/interstitial process, changes in the size of precipitates are shown to provide an independent indication of the solute redistribution. (auth)

12155 EFFECT OF IMPURITIES ON EMBRITTLEMENT OF FERRITE–PEARLITIC STEEL DURING NEUTRON IRRADIATION AND THERMAL AGING. Nikolaev, V. A.; Badanin, V. I. Izv. Akad. Nauk SSSR, Metal.; No. 2, 126-132(1975). (In Russian).

The tendency of ferritic–pearlitic reactor steel 15Kh2MFA to radiation embrittlement at irradiation temperatures of 50 to 80°C and 300 to 350°C increases in the presence of an increased content of phosphorous, antimony and tin ($\sim 10^{-2}$%). This effect on the radiation embrittlement was not detected with approximately the same concentrations of sulfur, lead and bismuth. The steel embrittlement becomes observable after irradiation at a temperature of 300 to 350°C with a dose of $\sim 10^{20}$ neutrons/cm^2, and is comparable to the embrittlement resulting from thermal aging for the same length of time at a temperature of 500°C. Irradiation of steel having a content of ~0.02% P at a temperature of 300 to 350°C causes an increased rate of etching in a solution of picric acid at the grain boundaries of the initial austinitic steel and the

appearance of signs of intercrystalline failure in the region of embrittlement. Apparently neutron irradiation promotes the transfer of dissolved impurities to the boundaries of existing austenitic grains, and this behavior leads to weakening of intergranular cohesion. (SJR).

12156 SOME ASPECTS OF THE MECHANICAL BEHAVIOR OF WELDS. Poirier, J.; Le Roy, P. Y.; Jolly, N. Metaux (Corros.-Ind.); 49: No. 591, 437-446(Nov 1974). (In French).

From meeting on welding metallurgy; Marseille, France (8 Nov 1973).

Two of the main peculiarities of the mechanical behavior of a weld are described. The first is the risk of brittle rupture from certain welding faults upon irradiation. From practical considerations, as inferred from linear rupture mechanics, the limits of use of such a welded assembly can be defined. The second is the existence of internal stresses, generated during the welding cycle, which in service add to the nominal stresses. An example is given to show how these can be measured. (FR)

12157 THE ELASTIC AND PLASTIC PROPERTIES OF IRRADIATED METALS. Quere, Y.; Leteurtre, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Section d'Etude des Solides Irradies). Ann. Mines; No. 2, 87-98(Feb 1975). (In French).

A brief description is given of the crystalline defects created by irradiation (neutrons, ions, electrons, etc.). The influence of these defects on the elastic and plastic behavior of materials is described. Hardening, embrittlement, and creep are the most usual incidents of irradiation. To this must be added dimensional instability for which a description will be relatively more detailed in proportion to the technical importance and the spectacular aspect of this phenomenon. (FR)

12158 SMALL CLUSTERS AND THEIR INFLUENCE ON MECHANICAL PROPERTIES IN IRRADIATED METALS. Eyre, B. L. (UKAEA, Harwell, Eng.). Int. Metall. Rev.; 19: 240-246(Dec 1974).

The main features of the damage processes occurring during different types of irradiation in metals are briefly summarized. Basic understanding of the physical processes involved in nucleation and growth of clusters are also summarised before the experimental observations made in irradiated metals are discussed. Finally irradiation hardening is considered in terms of the role played by clusters. (UK)

12159 RADIATION-INDUCED DIFFUSION IN Cu–Ni ALLOYS BELOW 200 K. Poerschke, R.; Wollenberger, H. (Kernforschungsanlage Juelich GmbH, Ger.). Radiat. Eff.; No. 4, 217-221(Mar 1975).

The residual resistivity of alloys with Ni contents between 42 and 71 at.% was investigated during 3-MeV electron irradiation at 25, 82, and 95°K as well as during isochronal annealing up to 350°K. During irradiation at the given temperatures the resistivity increases, probably due to point defect production. Significant resistivity recovery at temperatures between 120 and 200°K depending on alloy composition. At higher temperatures, the resistivity decrease still proceeds, causing strong negative resistivity changes due to alloy decomposition. From the observed decomposition temperature it is concluded that the required mass transport is due to interstitialcy migration. (auth)

12160 VOID FORMATION IN FAST-REACTOR MATERIALS. Nelson, R. S. (UKAEA, Harwell, Eng.). Int. Metall. Rev.; 19: 247-251(Dec 1974).

The phenomena of void swelling, the study of which has grown rapidly since the original discovery of internal porosity in the form of small cavities in austenitic stainless steel, is discussed. A few of the results which have made a significant contribution to the understanding of the phenomena or to the acquisition of design data are selected for review. Transmission electron micrographs show void and defect structures produced in DFR fuel pin cladding and indicate the marked effect of temperature on void density, void size, and total swelling. The effect of irradiation temperature on swelling rate for M316, M3162, FV548, and Nimonic PE16 are shown. Both FV548 and Nimonic PE16 show lower swelling rate and, in the case of PE16, very little temperature dependence. The use of charged-particle accelerators to simulate fast neutron void formation and of the high-voltage electron microscope to study the phenomena are discussed. The importance of the choice of material for PFR subassembly wrappers to resist void swelling is stressed. (UK)

12161 STRAIN RELAXATIONS DUE TO SELF-INTERSTITIAL ATOMS IN MOLYBDENUM. Mizubayashi, H.; Okuda, S. (Japan Atomic Energy Research Inst., Ibaraki). Phys. Status Solidi A.; 29: No. 1, K35-K41(16 May 1975).

Relaxation processes were studied in single crystal molybdenum irradiated with fast neutrons at liquid helium temperatures. Strain-relaxation measurements were made with an inverted torsion pendulum, and the results were correlated with internal friction peak data for similarly irradiated samples. (auth)

12162 SUMMARY OF EXPERIMENTAL RESULTS ON IN-REACTOR CREEP AND IRRADIATION GROWTH OF ZIRCONIUM ALLOYS. Fidleris, V. (Atomic Energy of Canada Ltd., Chalk River, Ont.). At. Energy Rev.; 13: No. 1, 51-80(Mar 1975).

A summary of all known experimental results on in-reactor creep and irradiation growth of zirconium alloys is presented in terms of behavioral trends. It covers the dependence of creep and growth on test conditions (neutron flux and dose, temperature and stress) and material variables (composition, texture, cold-work, grain size, and microstructure), together with irradiation-induced changes in density and ductility and post-irradiation annealing results. An outline of the in-reactor growth and creep mechanisms is also included. (auth)

12163 SURFACE BLISTERING OF MATERIALS EXPOSED TO ^{242}Cm ALPHA RADIATIONS. McDonell, W. R. (E. I. du Pont de Nemours and Co., Aiken, SC). Trans. Am. Nucl. Soc.; 21: 135-136(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12164 316 STAINLESS-STEEL SWELLING: SOME EFFECTS OF MINOR ALLOYING ELEMENTS. Ellis, J. A.; Appleby, W. K.; Lauritzen, T. (General Electric Co., Sunnyvale, CA). Trans. Am. Nucl. Soc.; 21: 153-154(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12165 SWELLING IN NEUTRON-IRRADIATED NICKEL-BASE ALLOYS. Brager, H. R. (Westinghouse Hanford Co., Richland, WA); Bell, W. L. Trans. Am. Nucl. Soc.; 21: 154-155(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12166 ANNEALING OF COPPER-VACANCY AGGREGATES IN NEUTRON-IRRADIATED FERRITIC PRESSURE VESSEL STEELS. Spitznagel, J. A.; Venskytis, F. J. (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc.; 21: 161(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12167 PREDICTION OF MAXIMUM UNIFORM STRAIN WITH SMALL MATERIAL PROPERTY VARIATIONS. Wang, P. Y. (Argonne National Lab., IL); Krieg, R. Trans. Am. Nucl. Soc.; 21: 162-163(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12168 COMPARISON OF VOID GROWTH KINETICS IN IRRADIATED STAINLESS STEELS AND PURE METALS. Mansur, L. K.; Farrell, K.; Stiegler, J. O. (Oak Ridge National Lab., TN). Trans. Am. Nucl. Soc.; 21: 163-164(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12169 COMPUTER SIMULATION OF THE EFFECT OF TEMPERATURE ON ATOMIC DISPLACEMENTS IN W METAL. Stuart, R. N.; Guinan, M. W. (Univ. of California, Livermore). Trans. Am. Nucl. Soc.; 21: 164(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12170 HELIUM DETRAPPING IN TUNGSTEN DURING IRRADIATION. Guinan, M. W.; Stuart, R. N. (Univ. of California, Livermore). Trans. Am. Nucl. Soc.; 21: 164-165(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12171 METHODS OF DETERMINING COMPOSITION CHANGES IN NEUTRON-IRRADIATED MATERIALS. Kopecki, D. S.; Ralls, K. M.; Draper, E. L. Jr. (Univ. of Texas, Austin). Trans. Am. Nucl. Soc.; 21: 165-166(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12172 COMPARISON OF RADIATION-ENHANCED DIFFUSION PRODUCED BY 14.8-MeV AND FISSION REACTOR NEUTRONS. Damask, A. C. (Univ. of California, Livermore); Van Konynenburg, R.; Borg, R. J.; Dienes, G. J. Trans. Am. Nucl. Soc.; 21: 166(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12173 NEUTRON RADIATION EMBRITTLEMENT OF STEELS. (International Atomic Energy Agency, Vienna). pp 93-145 of Neutron Irradiation Embrittlement of Reactor Pressure Vessel Steels. Steele, L. E. Vienna; International Atomic Energy Agency (1975).

See STI/DOC-10/163.

An assessment is given of the observed facts of neutron radiation embrittlement. This is done by outlining the theoretical basis of embrittlement, means for measuring it, and the influence of various factors which control the actions for minimizing embrittlement in future reactor steels. (34 fig, 6 tables, 73 references) (DLC)

12174 ENGINEERING IMPLICATIONS OF VESSEL STEEL EMBRITTLEMENT. (International Atomic Energy Agency, Vienna). pp 147-184 of Neutron Irradiation Embrittlement of Reactor Pressure Vessel Steels. Steele, L. E. Vienna; International Atomic Energy Agency (1975).

See STI/DOC-10/163.

Catastrophic failure of vessels must be prevented. An assessment of the general picture is made for each reactor type, identifying the possible detrimental consequences of steel embrittlement in the several reactor types (light water, gas cooled, pressure tube). Refinements in fracture mechanics application for assurance of pressure vessel integrity are coming in the future. (24 fig, 5 tables, 35 references) (DLC)

12175 CONTROLLING RADIATION EMBRITTLEMENT. (International Atomic Energy Agency, Vienna). pp 185-212 of Neutron Irradiation Embrittlement of Reactor Pressure Vessel Steels. Steele, L. E. Vienna; International Atomic Energy Agency (1975).

See STI/DOC-10/163.

Embrittlement can be varied by controlling the Cu, P content and the microstructure of pressure vessel steels. Control through metallurgy and annealing are discussed, including the service application of annealing to the SM-1A reactor. Improved steels (NiCrMo and MnMoNi) are reviewed; the summary and conclusions of J. R. Hawthorne on NiCrMo steels are repeated. (15 fig, 4 tables, 22 references) (DLC)

12176 STRESS-INDUCED POINT DEFECT-DISLOCATION INTERACTION AND ITS RELEVANCE TO IRRADIATION CREEP. Bullough, R.; Willis, J. R. (United Kingdom Atomic Energy Authority, Harwell, Eng.). Philos. Mag.; 31: No. 4, 855-861 (Apr 1975).

The general interaction energy between an applied stress and a misfitting inhomogeneity is presented and used to deduce the accurate elastic interaction between edge dislocations and point defects in a body subjected to aniaxial tension. It is shown that the external stress does, as conjectured by Heald and Speight (Heald, P. T. and Speight, M. V., 1974, Phil. Mag., 29, 1075), cause a preferential drift of interstitials and vacancies to dislocations with particular orientations to the external stress axis. Moreover, for a physically plausible range of the inhomogeneity representation of the point defects, the particular preferences found are consistent with those necessary to validate the mechanism of irradiation creep proposed by Heald and Speight. (auth)

12177 EFFECT OF ELECTRON IRRADIATION ON DISLOCATION BEHAVIOR IN Ni DURING IN-SITU DEFORMATION EXPERIMENT IN HVEM. Saka, H.; Noda, K.; Matsumoto, K.; Imura, T. (Nagoya Univ., Japan). Scr. Metall.; 9: No. 5, 499-504(May 1975).

Observations of radioinduced dislocations in Ni indicate that there is a great problem in interpretation for in-situ deformation experiments in a HVEM operating at an accelerating voltage higher than the threshold value for producing irradiation damage. The dislocation behavior being observed may be characteristic of the irradiation-damaged crystal rather than that of the unirradiated one. An example of the dislocation motions in Ni observed during in-situ deformation in a HVEM operating at an accelerating voltage of IMV is shown. In this case examination was made at relatively low illumination (the dose rate was about 10^{16} e.cm^{-2}. sec^{-1}.) by using an image intensifier (2 in. image orthicon tube). Still, under these circumstances the behavior of dislocations being observed was similar to that in a strongly irradiation-damaged Ni specimen; the dislocation behavior in Ni was affected considerably by electron irradiation during examination under this low illumination level. Therefore, the greatest effort should be taken in in-situ deformation experiments to avoid the formation of defects during examination. A few experimental techniques appear available to reduce the rate of defect formation, i.e., use of a high-sensitivity image intensifier and/or use of a reflection condition which is effective in reducing the damage rate to observe the dislocation image. However, the formation of defects is suppressed only partially even by using these techniques, especially in cases where observation is made on a thicker specimen observed at a higher accelerating voltage. In order to exclude completely the effect of irradiation defects, it is necessary to perform examination at an accelerating voltage below the threshold value, although the maximum observable specimen thickness is thereby reduced. This conclusion is valid at least in the case of Ni. (auth)

12178 EVIDENCE FOR ENHANCED ATOMIC MOBILITY DURING NEUTRON IRRADIATION USING THE ZENER RELAXATION. Halbwachs, M.; Gonzalez, H.; Hillairet, J. (CEN, Grenoble, France). Scr. Metall.; 9: No. 5, 575-582(May 1975).

Measurement of the rate of the Zener relaxation is potentially a convenient tool to follow directly and more specifically short range ordering. It has been shown to lead to reliable information about the formation energy and migration characteristics of thermal vacancies in the quenched condition. Experiments were conducted under conditions in which a defect supersaturation exists in a dynamic equilibrium state, as is the case in solids exposed to a neutron flux around or above room temperature. It was found that measurement of the rate of the Zener relaxation is a flexible and convenient tool for the study of radiation-induced point defects in binary substitutional alloys and their contribution to enhanced atomic mobility. (auth)

12179 INFLUENCE OF REACTOR RADIATIONS ON THE LONG-TERM STRENGTH OF Kh16N15M3B STEEL IN RELATION TO THE FORM OF THE STRESSED STATE. Kiselevskii, V. N.; Lukashev, V. K.; Polevoi, D. V.; Samsonov, B. V.; Losev, N. P. (Inst. of Strength Problems, Kiev). Strength Mater.; 6: No. 9, 1079-1082(Sep 1974).

Translated from Probl. Prochnosti; No. 9, 39-42(Sep 1974).

The creep life of Kh16N15M3B steel was found to be reduced after neutron irradiation. The extent to which the long-term strength of the steel diminshed as a result of irradiation was also found to be dependent on the form of the stressed state. (auth)

12180 SIMPLE MODEL FOR B_{c2} IN A15 MATERIALS AND THE EFFECTS OF DISORDER. Somekh, R. E. (Cambridge Univ., Eng.). J. Phys., F (London).; 5: No. 4, 713-720(Apr 1975).

A simple model calculation was made of the upper critical field of A15 superconducting materials. This was combined with ideas from work by Labbe, Friedel and van Reuth to explain some of the physical properties of disordered A15 materials in general and Nb_3Al in particular. (auth)

12181 CONTRACTION DUE TO SELF-IRRADIATION AT 4.2°K OF THE FACE-CENTERED CUBIC DELTA-PHASE OF PLUTONIUM. Zanghi, J. P.; Lefort, A.; Calais, D. (CEN, Fontenay-aux-Roses, France). J. Phys. Chem. Solids; 36: No. 6, 597-600 (Jun 1975). (In French).

Measurements were made of the initial rates of contraction due to self-irradiation damage at 4.2°K in PuSc fcc alloys containing 5, 12, and 18 at% scandium. The measured values were respectively -7.3×10^{-6}/h, -3.8×10^{-6}/h and -0.6×10^{-6}/h. From these values the formation volume of Frenkel pairs in each alloy was deduced. Then an attempt was made to explain the high negative values, with the help of the elastic theory, assuming that the radius of the interstitial atoms has been decreased by 5f → 6d electronic promotion. Afterwards the basic hypothesis of the calculation of the formation volume of Frenkel pairs has been investigated. On the existing grounds of the elastic theory the results cannot be understood quantitatively. However the negative formation volumes of interstitials and vacancies, therefore the weak volume of the former and the large relaxation of the latter, are not doubtful. (auth)

12182 EVIDENCE FOR ONE-DIMENSIONAL MIGRATION AND THERMAL CONVERSION OF STAGE-I_E INTERSTITIALS IN IRRADIATED COPPER. Frank, W. (Max-Planck-Institut fuer Metallforschung, Stuttgart); Seeger, A. Cryst. Lattice Defects.; 5: No. 3-4, 141-153 (1974).

After surveying the classical arguments which support an interpretation of radiation damage in fcc metals in terms of the so-called conversion-two-interstitial model, this paper concentrates on a quantitative analysis of the Thompson-Buck experiments on dislocation pinning in copper during ^{60}Co-γ irradiation. It is shown that the crowdion version of the two-interstitial model, which identifies the Stage-I_E defects with one-dimensionally migrating "off-line" crowdions and the Stage-III defects with three-dimensionally diffusing dumb-bell interstitials (generated mainly by conversion of both "on-line" and "off-line" crowdions), is capable of explaining the principal results of the Thompson-Buck experiment quantitatively. Both the one-interstitial model and Simpson and Sosin's modified two-interstitial model can be excluded unambiguously, since they fail to account for Thompson and Buck's results. These conclusions are independently verified by recent investigations of Roth, Wollenberger, Zeckau, and Lücke on dislocation pinning in copper during electron irradiation. (auth)

12183 VOLUME CHANGE DUE TO SELF INTERSTITIALS AND VACANCIES. Hertz, W. (Technische Univ., Darmstadt, Ger.); Waidelich, W.; Peisl, H.; Reichelt, K. Cryst. Lattice Defects.; 5: No. 3-4, 273-275(1974).

Combined measurements of lattice parameter and electrical resistivity change of platinum after electron irradiation at 4.5°K were performed. The specific volume changes due to defects in platinum are $(\Delta v/v)_F = 1.6 \pm 0.1$ for a Frenkel pair, $(\Delta v/v)_I = 2.0 \pm 0.2$ for a self interstitial. (auth)

12184 COMPARISON OF DISLOCATION PINNING EFFECTS IN COPPER WITH EXISTING THEORIES. Lauzier, J.; Minier, C.; Seiffert, S. L. (CEN, Grenobel, France). Philos. Mag.; 31: No. 4, 893-901(Apr 1975).

The variations of modulus and damping in copper were measured in the kHz range during electron irradiation at temperatures between 9 and 160°K. The results are compared with both Granato–Luecke (Granato, A. V. and Lucke, K., 1965, J. Appl. Phys., 27, 583) and Simpson–Sosin (Simpson, J. M. and Sosin, A., 1972, Phys. Rev., B5, 1382) models for dislocation damping. The results are in good agreement with the Granato–Luecke theory at low strain amplitude. A "peak" in the damping as a function of irradiation time appears at higher strain amplitude and the defect dragging mechanism proposed by Simpson and Sosin can explain this observation. (auth)

12185 SOME ELECTRON MICROSCOPY OBSERVATIONS OF 14 MeV NEUTRON DAMAGE IN NIOBIUM. Mitchell, J. B.; Van Konynenburg, R. A.; Guinan, M. W.; Echer, C. J. (Univ. of California, Livermore). Philos. Mag.; 31: No. 4, 919-927 (Apr 1975).

Structural damage was produced in two niobium specimens by irradiating them with 14-MeV neutrons. The first specimen was irradiated to a fluence of 420 neutrons nm^{-2} at 300°C and the second to a fluence of 6600 neutrons nm^{-2} at about 25°C. The structural damage in both cases was similar to that observed in fission neutron-irradiated niobium and consisted of either clusters of interstitials and vacancies or Frank dislocation loops ranging from about 1 to 12 nm in diameter. The size number-density distribution of clusters in the second specimen was compared with those reported for fission neutron-irradiated niobium at comparable fluences and temperatures. It was found that the rate of accumulation of displacement damage during 14-MeV neutron irradiation was substantially greater than that during irradiation with an equivalent flux of fission neutrons (E < 0.1 MeV). Evidence was observed of multiple cluster formation from high-energy displacement cascades. (auth)

12186 VACANCY MIGRATION AND VOID FORMATION DURING ANNEALING OF ELECTRON IRRADIATED MOLYBDENUM. Evans, J. H.; Eldrup, M. (United Kingdom Atomic Energy Authority, Harwell, Eng.). Nature (London).; 254: No. 5502, 685-686(24 Apr 1975).

Some studies are reported on the annealing of point defect damage produced in high-purity molybdenum electron irradiation. Three techniques were employed: resistivity changes, positron annihilation effects, and transmission electron microscopy. Two points of particular interest were noted, both arising directly from the sensitivity of the positron annihilation technique to vacancy defects. The first point concerns the well-known stage III recovery due to the annihilation of vacancies with interstitials, where there is controversy regarding the nature of the migrating species. The second point concerns the nature of clusters formed. It is concluded that it may be profitable to add positron annihilation measurements to the range of techniques used in such studies. (UK)

12187 DEPENDENCE OF ANGULAR WIDTH $\psi_{1/2}$ OF THE AXIAL DIP ON THE DEPTH OF PARTICLE PENETRATION INTO CRYSTAL. Kumakhov, M. A.; Muralev, V. A.; Rudnev, A. S.; Sirotinin, E. I. (Moscow State Univ.). Radiat. Eff.; 24: No. 4, 273-275(Mar 1975).

The depth dependence of angular width $\psi_{1/2}$ of the axial dip in the yield of backscattering of protons ($E_0 = 6.3$ MeV) from a tungsten single crystal was investigated experimentally. Interpretation of the results was based on a two-dimensional kinetic equation which accounts for the multiple scattering of channelled particles by electrons and thermal vibrations of the lattice. (auth)

12188 SPONTANEOUS RECOMBINATION VOLUME OF FRENKEL DEFECTS IN IRRADIATED BCC METALS. Biget, M. (CNRS, Orsay, France); Rizk, R.; Vajda, P.; Bessis, A. Solid State Commun.; 16: No. 7, 949-952(1 Apr 1975).

The spontaneous recombination volumes, α_r, of Frenkel pairs in Nb and W were determined to $\alpha_r^{Nb} = 540$ at. vol. and $\alpha_r^{W} = 190$ at. vol. A relationship is established between the α_r of several bcc metals and their compressibilities. The special cases of Cr and α-Fe are shown to be due to the magnetism of these metals. (auth)

12189 POSITRON ANNIHILATION IN NEUTRON-IRRADIATED COPPER CRYSTALS. Gauster, W. B.; Dolce, S. R. (Sandia Labs., Albuquerque, NM). Solid State Commun.; 16: No. 7, 867-870(1 Apr 1975).

Measurements of the angular correlation of positron annihilation radiation from neutron-irradiated copper crystals showed a distinct enhancement of the peak counting rate as a function of dose between 10^{16} and 10^{19} nvt (number density of neutrons x velocity x time). A comparison with the predictions of the trapping model shows that if the trapping rate for dislocation loops is assumed to be smaller than that for straight dislocations, the data are compatible with determinations of defect densities from electron microscopy. (auth)

Other Materials

Refer also to abstracts 11919, 11924, 12033, 12097, 13139–13143, 13161, 13310, and 13390.

12190 (BMFT-FB-K-75-01) TECHNICAL AND ECONOMICAL STUDY CONCERNING INTRODUCTION AND USE OF RADIATION CROSSLINKING OF CABLE AND WIRES IN THE FEDERAL REPUBLIC OF GERMANY. (Bundesministerium fuer Forschung und Technologie, Bonn (F. R. Germany)). Feb 1975. 84p. (In German). INIS.

After a short summary of cable classes, production, and application as well as the supply of plastics needed as insulation material, the amount of medium-voltage cables, telephone wires, high-frequency cables and special products with crosslinked insulations is estimated on the basis of the technical situation. For radiation crosslinking, with the exception of high-voltage cables, electron accelerators are available, which have been used satisfactorily in around-the-clock work in numerous American and Japanese cable production plants. Several ways of cable handling to obtain a homogeneous crosslinking of the total insulation material are discussed. Comparison of costs between crosslinking by electrons versus chemical crosslinking by peroxides results in a clear advantage of the radiation crosslinking for insulations up to 3 mm. Costs and other advantages are so substantial that existing chemical plants for crosslinking should be substituted by plants with electron accelerators. For medium-voltage cables, the radiation crosslinking offers cost benefits only for larger production volumes. Contrary to the German cable and wire industry, the USA has been introducing almost exclusively electron crosslinking plants for cables and wires with diameters up to 3 mm since the middle of the sixties. Practically all of the Japanese cable producers use electron accelerator plants. The study proposes the sponsoring of applications of radiation crosslinking in the Federal Republic of Germany. (GE)

12191 (CONF-731008-, pp 72-74) EXOELECTRON EMISSION OF EVAPORATED LiF FILMS. Huzimura, R.; Maeda, M.; Takahashi, A. (Nara Univ. of Education, Japan). 1973.

From 4th international symposium on exoelectron emission and dosimetry; Liblice, Czechoslovakia (1 Oct 1973).

In 4th international symposium on exoelectron emission and dosimetry, Liblice, Czechoslovakia, October 1–3, 1973.

The thermally stimulated exoelectron emission (TSEE) of evaporated LiF films after X-irradiation was studied. In films about 0.2 to 2μm in thickness, the F and Σ peaks appear in the same order of intensity, which is nearly $1/_{20}$ of the F peak intensity of the crystals. The as-evaporated films show also TSEE. (auth)

12192 (CONF-731008-, pp 79-81) EXOELECTRON EMISSION FROM CsI. Onsgaard, J.; Ennow, K. R. (Odense Univ., Denmark). 1973.

From 4th international symposium on exoelectron emission and dosimetry; Liblice, Czechoslovakia (1 Oct 1973).

In 4th international symposium on exoelectron emission and dosimetry, Liblice, Czechoslovakia, October 1–3, 1973.

Measurements of the exoelectron emission from pure single crystals and powder of CsI were carried out in both high vacuum and a gascounter. The emission was induced by X-ray irradiation and stimulated thermally (TS) and optically (OS). The samples showed OSEE and the threshold wave-lengths for emission were determined. Although no TSEE was found, a combined photo-thermal emission from single crystals was observed in vacuum. (auth)

12193 (CONF-731008-, pp 111-113) CALIBRATION AND RESOLUTION IN TSEE TRAP SPECTROSCOPY. Holzapfel, G.; Wolber, L. (Physikalisch-Technische Bundesanstalt, Berlin). 1973.

From 4th international symposium on exoelectron emission and dosimetry; Liblice, Czechoslovakia (1 Oct 1973).

In 4th international symposium on exoelectron emission and dosimetry, Liblice, Czechoslovakia, October 1–3, 1973.

An analysis of the thermal activation energies yields E = (1.08 ± 0.1)eV for barium sulfate and E = (1.26 ± 0.1)eV for strontium sulfate, the resolution being limited mainly by inhomogeneous surface temperature. (auth)

12194 (CONF-731008-, pp 126-132) EFFECTIVE SCAPE DEPTH OF PHOTOEMISSION FROM COLOR CENTERS IN CsCl. Soler, A.; Galan, L.; Rueda, F. (Universidad Autonoma, Madrid). 1973.

From 4th international symposium on exoelectron emission and dosimetry; Liblice, Czechoslovakia (1 Oct 1973).

In 4th international symposium on exoelectron emission and dosimetry, Liblice, Czechoslovakia, October 1–3, 1973.

In films of "specpur" CsCl, evaporated in UHV, color centers were created by irradiation of extended regions with 1 to 20 keV electrons at room temperature. Photoemission spectra show bands peaking at about 610 (F), 515, 420, 375 and 325 mm. For constant irradiation dose, the photoemission current was determined as a function of the electron energy for the different emission bands in the same specimen. Bleaching with white light was performed between irradiations. It is proposed, as a simple explanation of these curves, that at low energies, F centers are formed closer to the surface than the electron escape depth. At higher energies, however, the color centers are deeper, and a smaller fraction of the electrons freed can escape. Work with photons of different energies shows that the effective escape depths of electrons producing photoemission are identical for photon energies from 1.9 to 3.5 eV. It is concluded that photoemission for photon energies in this range is essentially due to thermal electrons from bulk processes. (auth)

12195 (CONF-731008-, pp 137-141) RETARDING FIELD MEASUREMENTS ON OPTICALLY STIMULATED EXOELECTRON EMISSION (OSEE) FROM K_2SO_4 SURFACES. Brunsmann, U.; Scharmann, A. (Univ., Giessen, Ger.). 1973.

From 4th international symposium on exoelectron emission and dosimetry; Liblice, Czechoslovakia (1 Oct 1973).

In 4th international symposium on exoelectron emission and dosimetry, Liblice, Czechoslovakia, October 1–3, 1973.

Potassium sulfate was chosen for an investigation of optically stimulated exoelectron emission due to its strong and only slowly decreasing emission intensity. 50 kV x-rays were used for sample stimulation, and, even after lengthy irradiation, the sample exhibited strong afteremission. The results show that sample charging may be controlled by external accelerating voltages, and that the retarding field method is sensitive to sample charging, band bending, and changes of electron affinity. (PMA)

12196 (CONF-731008-, pp 142-144) TEMPERATURE DEPENDENCE OF RATE CONSTANT OF OSEE OF GAMMA IRRADIATED EXO-SENSITIVE PAPER WITH $CaSO_4$ AND GRAPHITE. Kawanishi, M.; Kikuchi, R.; Okuma, J.; Ikeda, T. (Osaka Univ.). 1973.

From 4th international symposium on exoelectron emission and dosimetry; Liblice, Czechoslovakia (1 Oct 1973).

In 4th international symposium on exoelectron emission and dosimetry, Liblice, Czechoslovakia, October 1–3, 1973.

The decay curves of OSEE (optically stimulated exoelectron emission) of a gamma irradiated exo-sensitive paper prepared with $CaSO_4$ and graphite were measured at different temperatures with a gas-flow GM-counter. The temperature dependencies of rate constants and of OSEE intensity are discussed first by decomposition of the decay curve into two exponentials, and then by an empirical formula for the OSEE intensity versus time. (auth)

12197 (ORNL-SUB-3899-1) LONG TERM CREEP BEHAVIOR OF CONCRETE. Kennedy, T. W. (Texas Univ., Austin (USA)). Jan. 1975. 57p. Dep. NTIS $5.45.

For Oak Ridge National Lab., TN.

This report presents the findings of an experimental investigation to evaluate the long term creep behavior of concrete subjected to sustained uniaxial loads for an extended period of time at 75°F. The factors investigated were (1) curing time (90, 183, and 365 days); (2) curing history (as-cast and air-dried); and (3) uniaxial stress (600 and 2400 psi). The experimental investigation applied uniaxial compressive loads to cylindrical concrete specimens and measured strains with vibrating wire strain gages that were cast in the concrete specimen along the axial and radial axes. Specimens cured for 90 days prior to loading were subjected to a sustained load for a period of one year, at which time the loads were removed; the specimens which were cured for 183 or 365 days, however, were not unloaded and have been under load for 5 and 4.5 years, respectively. The effect of each of the above factors on the instantaneous and creep behavior is discussed and the long term creep behavior of the specimens cured for 183 or 365 days is evaluated. The findings of these evaluations are summarized. (17 figures, 10 tables) (auth)

12198 (UCRL-51818) DEVELOPMENT AND EVALUATION OF RADON SEALANTS FOR URANIUM MINES. Hammon, H. G.; Ernst, K.; Gaskill, J. R.; Newton, J. C.; Morris, C. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 21 May 1975. Contract W-7405-eng-48. 70p. Dep. NTIS $5.45.

Coatings for use as radon barriers were evaluated. Coating materials evaluated included epoxy resins, furfuryl alcohol polymers, styrenated polyesters, polyvinyl acetate, and acrylic emulsions. It was calculated that virtually all coatings with permeation constants lower than 10^{-10} cm^3/sub STP/.cm/s.cm^2.cm Hg and thicknesses between 5 and 10 mil will provide nearly 100 percent effectiveness. The selection of a suitable coating then ought to be based on other factors such as cost/m^2, vapor toxicity during application, ability to bind to the uranium ore in continuous films free of pin-holes etc. Obviously, any openings in the mine shafts and tunnels which are not covered with a film or any discontinuities of the film will act like the spillway on a water dam, i.e., the radon contained behind the barrier will flow out into the tunnel. (JRD)

12199 (ZFK-283, pp 107-108) COLOR CENTERS IN He^+-IRRADIATED KCl CRYSTALS. Karge, H.; Litvinov, V. V.; Prager, R. (Friedrich-Schiller-Univ., Jena, Ger.). Aug 1974. (In German).

In joint annual report, 1974.

12200 GROWING OF LITHIUM HYDRIDE SINGLE CRYSTALS BY THE CZOCHRALSKI METHOD. Truffier, J. L.; Bedere, S. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). C. R., Ser. C.; 280: No. 6, 337-340(10 Feb 1975). (In French).

Lithium hydride single crystals grown by the Bridgman method adhere to the crucible walls. The corresponding thermal stresses induce macroscopic defects in the crystal lattice. The Czochralski method was so tried and the first results presented here indicate that this method is an excellent way of growing lithium hydride single crystals. (FR)

12201 STUDY OF THE ANNEALING BEHAVIOR OF HIGH DOSE IMPLANTS IN SILICON AND GERMANIUM CRYSTALS. Kraeutle, H. (California Inst. of Tech., Pasadena). Radiat. Eff.; 24: No. 4, 255-262(Mar 1975).

High doses of 3×10^{14} to 3×10^{16} ions/cm^2 of Ge, Sn, Pb, Pt, Pd, In, Sb, and Tl ions were implanted into silicon and germanium single crystals with energies between 35 and 60 keV. The annealing behaviour of the implanted layers was studied with electrical and backscattering methods. The change of the electrical properties are correlated with the reordering process of the implanted layer. The damaged layer in the silicon crystal starts to anneal at 600°C and in the germanium crystal at 400°C, nearly independent on the ion species. The reordering process itself is dose dependent, even for doses greater than 10^{16} ions/cm^2. Some of the implanted ions can be found as substitutionals after annealing, like Ge in silicon at 600°C and In in germanium at 400°C. (auth)

12202 CORRELATION OF PROTON DAMAGE OF SILICON WITH NEUTRON AND ELECTRON DAMAGE. Colwell, J. F. (Intelcom Rad Tech., San Diego, CA). Radiat. Eff.; 24: No. 4, 239-245(Mar 1975).

The damage introduced in a semiconductor is made evident by a change in minority-carrier lifetime. Irradiation by electrons produces relatively low-energy silicon-atom primary recoils which, in turn, produce isolated defect centers. Neutron irradiation produces high-energy recoils which create clusters of damage, as first discussed by Gossick. In the case of proton irradiation, both high- and low-energy recoils are produced. This physical process is used to derive a quantitative means of extrapolating proton damage from electron and neutron data. This is done by using cross-section data or theory to calculate the number of recoil atoms produced with energy E_p. If $E_p < 20$ keV, the defects are "electron-like," N_E; otherwise, they are "neutron-like," N_N. The change in reciprocal lifetime per unit fluence (cm^{-2}) is equal to $k_E N_E$ plus $k_N N_N$, where k_E(= 5.4×10^{-9}cm^2/sec) and k_N(= 10^{-5} cm^2/sec) are found from appropriate experiments reported in the literature. This rule is used to calculate the lifetime in silicon that has been irradiated by protons. The calculated lifetime compares well with the lifetime that Berman has deduced from solar cell degradation data. (auth)

12203 CONCENTRATION PROFILES OF BORON IMPLANTATIONS IN AMORPHOUS AND POLYCRYSTALLINE SILICON. Hofker, W. K.; Costhoek, D. P.; Kowman, N. L.; de Grefte, H.A.M. (Philips Glaeilampenfabrieken N. V.; Eindhoven, Netherlands). Radiat. Eff.; 24: No. 4, 223-231(Mar 1975).

Boron was implanted in amorphous silicon at 30 to 200 keV and in polycrystalline silicon at 70 to 800 keV. The boron distribu-

tions were measured with secondary ion mass spectrometry. It was found that the polycrystalline silicon behaves similarly to amorphous silicon for the boron stopping process. It was found that with the first four moments of the experimental distributions, an analytic description of the experimental distributions can be given by distributions of the Pearson system. The moments are determined by curve fitting of Pearson distributions to experimental distributions. In this way a systematic extrapolation of the low-energy distributions outside the surface is automatically obtained. The moments are compared with the moments calculated by Winterbon and others. A satisfactory correspondence between the experimental and theoretical average ranges and standard deviations is obtained using an electronic stopping coefficient that is 1.5 times the value given by standard LSS theory. The correspondence for the skewness is less good, while for the kurtosis a distinct discrepancy is found between the experimental and theoretical values. By comparing experimental and theoretical ranges on a differential basis, an electronic stopping cross section is obtained whose energy dependence deviates from velocity proportionality. (auth)

12204 SLOW CRACK GROWTH IN GRAPHITE. Hodkinson, P. H.; Nadeau J. S. (British Columbia Univ., Vancouver, Can.). J. Mater. Sci.; 10: No. 5, 846-856(May 1975).

Slow crack growth tests on isotropic graphite and pyrolytic graphite at room temperature have revealed a stress intensity-crack velocity behavior similar to the third stage of crack growth in soda-lime glass. Thus, it appears that graphite undergoes failure at room temperature only at large fractions of the critical stress intensity. Considerable difference in fracture behaviour of graphites having different microstructures was observed. Slow crack growth occurred more readily at 500°C than at room temperature, suggesting an environmental effect. (auth)

12205 RELATION BETWEEN THERMAL-EXPANSION COEFFICIENT AND CRYSTAL STRUCTURE IN GRAPHITE MATERIALS. Virgil'ev, Yu. S.; Lukina, E. Yu. Inorg. Mater.; 10: No. 11, 1787-1789(Nov 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 11, 2084-2086(Nov 1974).

The thermal expansion coefficients and the crystallite dimensions were measured in various grades of Soviet-made graphite, before and after neutron irradiation. The expansion coefficient was found to increase as the side surface area of the crystallites decreased and as the diameter-height ratio of the crystallites increased. (auth)

12206 THORIUM PHOSPHITES. Avduevskaya, K. A.; Mironova, V. S.; Demidova, T. A. (Inst. of General and Inorganic Chemistry, Moscow). Inorg. Mater.; 10: No. 11, 1760-1763(Nov 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 11, 2052-2056(Nov 1974).

As a result of an investigation of the reaction of Th ions with phosphorous acid, basic, neutral, and acid phosphites of thorium were obtained, with compositions $Th_2(OH)_{2x}(HPO_3)_{4-x} \cdot mH_2O$ ($x \leq 1$), $Th(HPO_3)_2 \cdot 2H_2O$, and $Th(HPO_3)(H_2PO_3)_2 \cdot 2H_2O$, $Th(H_2PO_3)_4 \cdot 2H_2O$. Also observed was the formation of thorium pyrophosphite $Th(H_2P_2O_5)_2$ when $Th(H_2PO_3)_4 \cdot 2H_2O$ is heated to 250°C. Roasting converts the neutral phosphite quantitatively to the pyrophosphite, while acid phosphites are converted to polyphosphates. (auth)

12207 TEMPERATURE DEPENDENCE OF THE MEAN VELOCITY OF PHONONS IN GRAPHITE. Lutkov, A. I.; Volga, V. I.; Dymov, B. K. Inorg. Mater.; 10: No. 11, 1694-1696(Nov 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 11, 1976-1978(Nov 1974).

A calculation of the temperature dependence of the mean phonon velocity in the basal plane of graphite is presented. (auth)

12208 INJECTION ANNEALING OF Ge-BASED DIFFUSED DIODES AFTER IRRADIATION WITH FAST NEUTRONS. Afanas'ev, V. N.; Tuturov, Yu. F.; Filimoncheva, P. I. Inorg. Mater.; 10: No. 11, 1653-1656(Nov 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 11, 1926-1931(Nov 1974).

Annealing was studied in p-type and n-type Ge at 77°K after irradiation with fast neutrons. It is proposed that injection anneal ing depends on the presence of two types of carriers, and is not due to charge exchange between defects during injection. Injection annealing in p-type Ge irradiated at 77°K is of the same nature regardless of whether the irradiation is by 14-MeV neutrons or fission-spectrum neutrons. (auth)

12209 DEFECT CENTERS IN SILICON PRODUCED BY ROOM TEMPERATURE ELECTRON IRRADIATION. II. Thermally stimulated conductivity studies. Natarajan, K.; Heasell, E. L. (Univ. of Waterloo, Ontario). Phys. Status Solidi A.; 29: No. 1, 207-212(16 May 1975).

The results of thermally stimulated conductivity (TSC) studies on high resistivity, oxygen free, electron irradiated silicon are presented. Two isolated TSC peaks are observed centered around 150 and 250°K. The peaks were studied by controlled variation of the sample heating rate. The results indicate the presence of hole trapping centers having energy levels of (E_v + 0.25) and (E_v + 0.42) eV. These levels are related to the defect centers observed in the same set of samples by study of the extrinsic photoconductivity. (auth)

12210 LOW-TEMPERATURE MICROWAVE ABSORPTION IN NATURAL AND PYROLYTIC GRAPHITES. Alquie, G.; Kreisler, A. (Univ., Paris). Phys. Status Solidi A.; 29: No. 1, 77-86(16 May 1975).

The radiofrequency power absorption of several natural and pyrolytic graphite samples was studied between 1.5 and 50K up to 0.55 T with an 11 GHz reflection spectrometer. Due to the geometry of the microwave fields relatively to the sample, electron spin resonance, magnetoresistance oscillations, and Alfvén-wave propagation could be observed. A tentative explanation for the disappearance of the ESR signal at low temperature when B_0 lies parallel to the c-axis is given. Alfvén-wave interference data from the thinnest samples are used to compute the mean effective collision time. In the thick samples the absorption is dominated by Shubnikov-de Haas oscillations with the majority electron period as the fundamental one. Well oriented pyrolytic data agree with previous results. (auth)

12211 MEASUREMENTS OF MAGNETIC SUSCEPTIBILITY ON AMORPHOUS BORON. Kubler, L.; Gewinner, G.; Koulmann, J. J.; Jaegle, A. (Centre Univ. de Haut-Rhin, Mulhouse, France). Phys. Status Solidi B.; 69: No. 2, 323-327(1 Jun 1975).

Magnetic susceptibility measurements on amorphous boron samples were performed between 77 and 1300°K. Surface impurities present in the amorphous powder (according with a small particle size) have made measurements difficult. These impurity contributions being eliminated, a paramagnetic susceptibility signal, rising exponentially with the temperature above room temperature was found, just as in β-rhombohedral boron. The presence of the same sort of electronic states in the forbidden band gap of the two compounds is concluded. (auth)

12212 HIGH TEMPERATURE CREEP OF CONCRETE. Gross, H. (Imperial Coll. of Science and Technology, London (UK)). Nucl. Eng. Des.; 32: No. 1, 129-147(Apr 1975).

116 refs.

Axisymmetric or spherical concrete structures designed with tensioned steel reinforcement are used in civil engineering practice as reactor pressure vessels, containers for chemicals, water towers or reservoirs, submarine oil tanks, caissons, bunkers, air-raid shelters, silos, cupolas, lighthouses, industrial chimneys, television aerial masts and central pylons for suspended cooling towers. In the course of analyzing such structures using finite element and finite difference computing techniques, the author investigated the behaviour of concrete at ambient, elevated and high temperatures, and subsequently studied its effects on the structures' strain history. Since stress analysis problems of continua are insoluble in closed form except for simple ideal geometries, the strain history is reproduced matrix-theoretically by defining sets of scalar thermal relaxation factors which act as multipliers of the coefficients of the structures' stiffness matrix as present in the global force-deformation equation. (auth)

12213 DEVELOPMENT OF REACTOR-GRADE GRAPHITE. MacPherson, H. G. (Univ. of Tennessee, Knoxville); Eatherly, W. P. Trans. Am. Nucl. Soc.; 21: 169-170(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12214 NEAR-ISOTROPIC GRAPHITE FOR HIGH-TEMPERATURE GAS-COOLED REACTORS. Meers, J. T.; McGrellis, J. R.; Bushong, R. M.; Goldman, A. E. Trans. Am. Nucl. Soc.; 21: 185(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12215 EQUILIBRIUM POTENTIALS OF THORIUM IN MIXED FLUORIDE-CHLORIDE MELTS. Kudyakov, V. Ya.; Posokhin, Yu. V.; Shishkin, V. Yu. Tr. Inst. Elektrokhim., Ural. Nauch. Tsentr. Akad. Nauk SSSR; No. 21, 32-38(1974). (In Russian).

Measurements are made of the equilibrium potentials of thorium in mixed fluoride-chloride melts as a function of temperature (700, 800 and 900°C) and fluoride concentration at 0.44 and 1.53 mol % Th. The introduction of fluoride substantially shifts the electrode potentials of thorium to the negative side as a result of the formation of fluoride complexes in the melt. It is shown that most of the thorium ions form complexes of the composition ThF_5^{3-} and ThF_7^{3-}, and a method is proposed for calculating

arbitrary instability constants of these complexes in melts containing not more than ~7.0 mol % $ThCl_4$. (SJR)

12216 PRODUCTION METHOD FOR CONCRETE STONE CLAD ALL-ROUND WITH SYNTHETIC MATERIAL TO SERVE AS SHIELDING. (to Bredero's Bouwbedrijf Nederland BV). Netherlands Patent 7,306,352/A/. 7 May 1973. 4p. (In Dutch).

The invention consists in covering concrete building stones with a layer of plastic or synthetic material in order to facilitate fast disassembly and decontamination. The plastic cover is made first and serves as mould for the concrete. The filling hole is closed with synthetic mortar. (auth)

12217 NEW FAMILY OF BORON-BASED MULTIPLE OXIDES: $M^{I}M'^{V}B_2O_6$ (M = Tl, Rb; M' = Nb,Ta). Baucher, A.; Gasperin, M. (CNRS, Paris). Mater. Res. Bull.; 10: No. 6, 469-472(Jun 1972). (In French).

Three new compounds were prepared as single crystals. They crystallise in the orthorhombic system, space group $Pn2_1m_0$ or $Pnm2_1$. Their cell edges are: $TlTaB_2O_6$ a = 5 × 3,86 b = 9,50 c = 7,44 Å; $RbNbB_2O_6$ a = 5 × 3,94 b = 9,49 c = 7,42 Å; $RbTaB_2O_6$ a = 5 × 3,88 b = 9,52 c = 7,44 Å show that they are isotype with $TlNbB_2O_6$ and form a new family of double borates with it. (auth)

12218 SULFIDES OF U_3S_5 TYPE FORMED BY U AND THE RARE EARTHS $Ln_2^{III}US_5$ (Ln^{III} = La to Gd) and $Ln^{II}U_2S_5$ (Ln^{II} = Sm^{II} and Eu^{II}) AND THEIR SOLID SOLUTIONS. Tien, V. (CNRS, Paris); Guittard, M.; Flahaut, J.; Rodier, N. Mater. Res. Bull.; 10: No. 6, 547-554(Jun 1975). (In French).

The trivalent rare earth sulfides (La to Gd, Eu excepted), combine with US_2 give Ln_2US_5 orthorhombic sulfides, spatial group Pnma, U_3S_5-type. The crystal structure of $Sm_2^{III}US_5$ is established from single crystals determinations (R = 0.05); the atomic positions are identical to those of U_3S_5. These compounds form continuous solid solutions with U_3S_5. These compounds form continuous solid solutions with U_3S_5 by substitution of Ln^{III} by U^{III}, and partial solid solutions with US_2 by a mechanism involving substitution of Ln^{III} by U^{IV} and vacancies. The two compounds $Eu^{II}U_2S_5$ and $Sm^{II}U_2S_5$ are isostructural with the preceding ones, from a single crystal study. A continuous passage from $Sm_2^{III}US_5$ to $Sm^{II}U_2S_5$ and to U_3S_5 is observed. (auth)

12219 SIGN OF THE PRINCIPAL G VALUES OF DEEP IMPURITY AND RADIATION INDUCED DEFECTS IN SILICON AND DIAMOND. Strnisa, F. V.; Corbett, J. W. (State Univ. of New York, Albany). Cryst. Lattice Defects.; 5: No. 3-4, 261-268(1974).

A TM 110, bimodal, circularly polarized, X-band cavity and microwave bridge were built and are described. The system was used to measure the signs of the principal values of the g tensor of some deep level spin resonance centers in silicon and diamond. The signs of the principal values of eight defects produced by room temperature neutron irradiation of silicon were measured; these centers were the P-1, P-3, P-6, A-2, A-3, A-4, A-5 and A-10. The signs, or the product of the signs, of the principal g values of these radiation induced centers were determined to be positive. In addition, six impurity-associated defects in silicon were measured: the chromium $(^{53}Cr)^{\circ}$ substitutional; the chromium $(Cr)^{+}$ interstitial; a center associated with sulfur $(S)^{+}$; a center associated with platinum Pt(ID; a center associated with palladium Pd^{-}; and the iron-boron $(Fe\text{-}B)^{\circ}$ impurity pair. The signs, or the product of the signs, of the principal g values of these impurity associated centers in silicon were determined to be positive. The sign of the principal g value of the substitutional nitrogen donor in diamond was also determined to be positive. (auth)

12220 INFRA-RED LUMINESCENCE OF METASTABLE ELECTRON EXCESS CENTERS IN ALKALI HALIDES. Ortega, J. M.; Lagarde, P.; Farge, Y. (Paris Univ., Orsay, France). Solid State Commun.; 16: No. 7, 957-959(1 Apr 1975).

An infrared luminescence, associated with the decay of the F_2 center triplet state, was observed in KBr, KI, and KCl. In KCl and NaCl, an infrared emission related to the quartet decay of the F_3 centers was also seen. (auth)

12221 ION ETCHING OF AMORPHOUS AND SEMICRYSTALLINE FIBRES. Warner, S. P. (Massachusetts Inst. of Tech., Cambridge); Uhlmann, D. R.; Peebles, L. H. Jr. J. Mater. Sci.; 10: No. 5, 758-764(May 1975).

Ion etching of amorphous and semicrystalline fibres produces structures which can be observed in either the transmission electron microscope or the scanning electron microscope. The structures so produced have previously been identified as resulting from the etching process (artifacts), or as representing characteristics of the material, or both. The artifacts can be eliminated or minimized by rotating the sample during irradiation, using a low angle of incidence, and ensuring that the temperature of the sample surface remains low. When such precautions are used, amorphous fibres and semicrystalline fibres which are not oriented remain featureless after ion etching. Oriented semicrystalline fibres, however, develop a striated structure which is oriented perpendicular to the stretch direction. The spacing between the striations is in the range of 500 to 5000 Å, an order of magnitude larger than the characteristic lamellar spacing in the materials. These transverse structural features reflect characteristic features of drawn fibres; but the relation between these features and the lamellar spacing is unclear. (auth)

12222 GLASS TRANSITION TEMPERATURE AND MOLECULAR WEIGHT DISTRIBUTION OF IRRADIATED POLYMETHYLMETHACRYLATES. Pratt, G. J. (Melbourne Univ., Parkville, Australia). J. Mater. Sci.; 10: No. 5, 809-813(May 1975).

A mechanical torsion pendulum was used to observe changes in viscoelastic behavior resulting from modification of polymer structure. The linear dependence of transition temperature on reciprocal average molecular weight has been confirmed for irradiated polymethylmethacrylate polymers. Gel permeation measurements are consistent with simultaneous end-linking and chain scission at low radiation levels, leading to apparently anomalous behavior in irradiated "Perspex". (auth)

NUCLEAR MATERIALS AND WASTE MANAGEMENT

Accountability and Safeguards

12223 (REG/G-5.51(6-75)) MANAGEMENT REVIEW OF NUCLEAR MATERIAL CONTROL AND ACCOUNTING SYSTEMS. (Nuclear Regulatory Commission, Washington, D. C. (USA). Office of Standards Development). Jun 1975. 21p. NRC.

Section 70.58, "Fundamental Nuclear Material Controls," of 10 CFR Part 70, "Special Nuclear Materials," requires, in paragraph 70.58(c), that certain licensees authorized to possess more than one effective kilogram of special nuclear material establish a management system to provide for the development, revision, implementation, and enforcement of nuclear material control and accounting procedures. Such a system must provide for a review of the nuclear material control system at least every 12 months. This guide describes the purpose and scope, personnel qualifications, depth of detail, and procedures that are acceptable to the NRC staff for the management review of nuclear material control systems required under paragraph 70.58(c) of 10 CFR Part 70. (TFD)

12224 SECURITY OF FISSIONABLE MATERIAL. III. Technical Aspects. Harry, R. J. S. (Stichting Reactor Centrum Nederland, The Hague). Atoomenerg. Haar Toepass.; 17: No. 4, 82-91(Apr 1975). (In Dutch).

Correlation aspects are considered for isotope production of heavy elements for a number of nuclear power reactors, summarised as % ^{235}U to ^{238}U and Pu/U ratio relative to ^{235}U and also the fractions $^{239}Pu/^{240}Pu$ to $^{240}Pu/^{242}Pu$. Gamma spectrometric methods are reviewed in detail, both absorption and radiation methods being considered. Neutron emission analysis is also a technique of interest, and an illustration is given of a neutron generator in conjunction with a neutron monitor situated inside a lead shield. The article concludes with a note on the "Variable Dead Time Counter" developed at Ispra, which has applications to ^{240}Pu analysis for quantities from 0.03 to 100g. (NL)

12225 UNIFORMITY AND TOTAL CONTENT OF FISSILE MATERIAL IN REACTOR FUEL RODS. Bramblett, R. L.; Costello, D. G. (IRT Corp., San Diego, CA). Trans. Am. Nucl. Soc.; 21: 118(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12226 RAPID CALORIMETRIC ASSAY OF PLUTONIUM. Rodenburg, W. W.; Dudley, W. A.; Otto, G. W.; Birden, J. H. (Monsanto Research Corp., Miamisburg, OH). Trans. Am. Nucl. Soc.; 21: 119(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12227 STATUS OF PLUTONIUM ISOTOPIC MEASUREMENTS BY GAMMA-RAY SPECTROMETRY. Gunnink, R. (Univ. of California, Livermore). Trans. Am. Nucl. Soc.; 21: 119-120 (Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12228 NUCLEAR DATA NEEDS FOR SAFEGUARDS. Higinbotham, W. A.; Weinstock, E. V. (Brookhaven National Lab., Upton, NY). Trans. Am. Nucl. Soc.; 21: 120-121(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12229 NONDESTRUCTIVE ASSAY PHYSICAL STANDARDS AND TODAY'S SAFEGUARDS REQUIREMENTS. Bishop, D. M. (General Electric Co., San Jose, CA); Chanda, R. N.; Shea, T. E.; Smith, D. B. Trans. Am. Nucl. Soc.; 21: 121-122(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12230 EXTERIOR INTRUSION ALARMS FOR PLANT PERIMETER SAFETY. Hightower, E. D. (Energy Research and Development Administration, Washington, DC). Trans. Am. Nucl. Soc.; 21: 123(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12231 PHYSICAL SECURITY AT ROCKY FLATS. Martinez, J. L.; Cunningham, G. J. (Dow Chemical Co., Golden, CO). Trans. Am. Nucl. Soc.; 21: 123-124(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12232 DEVELOPMENT OF A HIGHLY SENSITIVE METAL DETECTOR. Ellis, J. F. (Union Carbide Corp., New York). Trans. Am. Nucl. Soc.; 21: 124-125(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12233 DEVELOPMENT OF ADVANCED SYSTEM CONCEPTS FOR MATERIAL PROTECTION. Sellers, T. A.; de Montmollin, J. M. (Sandia Labs., Albuquerque, NM). Trans. Am. Nucl. Soc.; 21: 125(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12234 SYSTEMS APPROACH TO PHYSICAL SECURITY. Taylor, T. B. (International Research and Tech. Corp., Arlington, VA). Trans. Am. Nucl. Soc.; 21: 125-126(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12235 FACILITY SECURITY: DOES THE SHOE FIT THE FOOT. Wilson, D. W. (General Electric Co., San Jose, CA). Trans. Am. Nucl. Soc.; 21: 126(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12236 SECURITY SYSTEM FOR THE TRANSPORT OF SPECIAL NUCLEAR MATERIALS. Blake, V. E. Jr.; Jacobs, J. (Sandia Labs., Albuquerque, NM). Trans. Am. Nucl. Soc.; 21: 127(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12237 APPLICATION OF LORAN-C TO VEHICLE TRACKING. Tuttle, L. P.; Vogeler, W. K. (Telcom, Inc., Vienna). Trans. Am. Nucl. Soc.; 21: 128-129(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12238 DEVELOPMENTS IN SEARCH AND SURVEY INSTRUMENTATION. Chambers, W. H. (Los Alamos Scientific Lab., NM). Trans. Am. Nucl. Soc.; 21: 129(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12239 SEARCH METHODS FOR RADIOACTIVE MATERIALS. Doyle, J. F. (EG and G, Inc., Las Vegas, NV). Trans. Am. Nucl. Soc.; 21: 129-130(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12240 SAFEGUARDS ASPECTS OF SPENT NUCLEAR FUEL. Malanify, J. J.; Augustson, R. H. (Los Alamos Scientific Lab., NM). Trans. Am. Nucl. Soc.; 21: 487(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12241 PROGRESS WITH THE LEAD SPECTROMETER FOR FISSILE MATERIAL ASSAY. Conn, R. W.; Beranek, F.; Darby, J.; Vogelsang, W. F. (Univ. of Wisconsin, Madison). Trans. Am. Nucl. Soc.; 21: 489-490(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12242 REACTOR PHYSICS ASPECTS OF ISOTOPIC CORRELATIONS. Christensen, D. E.; Kottwitz, D. A.; Prezbindowski, D. L.; Schneider, R. A. (Battelle Pacific Northwest Labs., Richland, WA). Trans. Am. Nucl. Soc.; 21: 490(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12243 SELECTION OF NDA TECHNIQUES FOR ^{232}Th–^{233}U REPROCESSED FUEL. Jenkins, J. D.; Rushton, J. E.; McNeany, S. R. (Oak Ridge National Lab., TN). Trans. Am. Nucl. Soc.; 21: 491(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

Disposal and Storage

Refer also to abstracts 11255, 11270, 11725, 13627, and 13696.

12244 (AECL-5111) AECL'S RESPONSIBILITIES AND PROGRAMS FOR MANAGEMENT OF HIGH LEVEL RADIO-

ACTIVE WASTES. Dyne, P. J. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). May 1975. 19p. Dep. NTIS (US Sales Only) $4.00. AECL $0.50.

Two general objectives for the management of radioactive wastes are enunciated. These are that they should be managed in such a way that the potential hazards of the material are minimized to the greatest extent practicable and, they should be managed in such a way that the trouble and concern to future generations in keeping them safely will be minimized. The implications of these objectives on development programs for waste management are discussed together with an outline of the present status of these programs. (auth)

12245 (AERE-R-7977) INVESTIGATIONS INTO THE EFFECTS OF DEEP-SEA PRESSURES ON DISPOSAL PACKAGES. King, W. H.; Hill, S. S. (UKAEA Research Group, Harwell Atomic Energy Research Establishment). Mar 1975. 24p. Dep. NTIS (US Sales Only) $4.25. UK 50p.

Experiments are described in which various types of packages used for the disposal of low-level radioactive waste were photographed during descent to the sea bed at depths greater than 3800 meters. Some of the packages were allowed to fall freely to the sea bed and others were lowered by cable and then retrieved. Sketches of the packages used and photographs taken during the experiments are appended. (auth)

12246 (BNL-19981) TRITIUM STORAGE DEVELOPMENT. Progress Report No. 3, January–March 1975. Colombo, P. (Brookhaven National Lab., Upton, N. Y. (USA)). Apr 1975. 22p. Dep. NTIS $4.25.

Process development for the fixation of tritiated wastes in polymer impregnated tritiated concrete (PITC) has proceeded with an emphasis on mixing techniques. Leach testing of preliminary PITC formulations has continued. Improvement of formulational techniques has resulted in fractional tritium releases as low as 7.25×10^{-5} per day. The leach rates obtained for these composites are lower than those obtained by other workers using coatings, which introduce additional operational problems. Gas evolution due to composite radiolysis and tritium transmutation to ^{3}He have been calculated for PITC composites incorporating high level tritiated waste. Such calculations indicate no significant container pressurization or internal composite pressurization problems. Waste from heating due to tritium decay for PITC composites incorporating high level wastes was found to be negligible. Initial leach testing data for a silica gel tritiated polymer concrete (PC) are reported. (auth)

12247 (KFK-2124) INTERACTIVE PROGRAM FOR MANAGING A STORAGE FOR RADIOACTIVE WASTE. Antonczyk, R. (Kernforschungszentrum Karlsruhe (F. R. Germany). Abt. Datenverarbeitung und Instrumentierung). Mar 1975. 64p. (In German). Dep. NTIS (US Sales Only) $6.25.

A program of APL-PLUS functions for the management of the GfK storage for radioactive waste is described. The possibilities offered by the file sub-system of APL-PLUS are used. It is the aim of this program to save manpower in the management of the storage for radioactive waste. Since the staff that will use this program has little or no knowledge of data processing, the program must be easy to handle. Hence, it is as interactive as possible. (auth)

12248 (ORNL-TM-4826) CONCEPTUAL DESIGN REPORT: NEW HYDROFRACTURE FACILITY. Lampton, R. E.; Robinson, R. A.; Weeren, H. O. (Oak Ridge National Lab., Tenn. (USA)). July 1975. Contract W-7405-eng-26. 101p. Dep. NTIS $8.25.

The design, construction, cost, safety, and environmental effects of a proposed Hydrofracture Waste Disposal Facility at the Holifield (Oak Ridge) National Laboratory a re presented. (LCL)

12249 (RFP-2374) STORAGE CAPACITY FOR FISSILE MATERIAL AS A FUNCTION OF FACILITY SHAPE (ROOM LENGTH-TO-WIDTH RATIO). Altschuler, S. J. (Dow Chemical U.S.A., Golden, Colo. Rocky Flats Div.). 27 May 1975. Contract AT(29-1)-1106. 16p. Dep. NTIS $4.00.

The results of a previous study for applying surface density methods to square room of varying size are shown to be conservative for rectangular rooms as well. The surface density required to produce criticality has been calculated as a function of the facility length to-width ratio for a variety of room widths and unit sizes, shapes, and fissile material compositions. For a length to width ratio greater than or equal to 6, the critical surface density is essentially constant. This allows further economies since more fissile material can be stored at a given subcritical value of k/sub eff/(0,90) in a rectangular vault of given usable area than in a square one. (auth)

12250 RADIOACTIVE AND TOXIC WASTES: A COMPARISON OF THEIR CONTROL AND DISPOSAL. Kenny, A. W. (Dept. of the Environment, London). Chem. Soc. Rev.; 4: No. 1, 90-98 (1975).

From handling toxic chemical: environmental considerations; London (13 Nov 1973).

An account is given of the legal aspects of the control and disposal of radioactive wastes arising in the United Kingdom, and of the radiological principles on which the legislation is based. This situation is then contrasted with the control and disposal of nonradioactive toxic wastes in this country. In conclusion, consideration is given to the possibility of applying more widely (i.e. to nonradioactive toxic wastes) the principles of control of radioactive wastes. (UK)

12251 OPTIMUM RELIABILITY DESIGN OF RADWASTE SYSTEMS. Lipner, M. H. (Carnegie-Mellon Univ., Pittsburgh); El-Bassioni, A. A.; Lehmann, P. H. Trans. Am. Nucl. Soc.; 21: 203-204(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12252 STANDARDS PROGRAM FOR THE NUCLEAR FUEL CYCLE. Minogue, R. B. (Nuclear Regulatory Commission, Washington, DC). Trans. Am. Nucl. Soc.; 21: 239-240(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12253 SAFETY CONTROL OF NUCLEAR PROCESSING INSTALLATIONS IN THE UNITED KINGDOM. Williams, E. C. (British Nuclear Installations Inspector, London). Trans. Am. Nucl. Soc.; 21: 240(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12254 TRANSURANIUM-CONTAMINATED WASTE RESEARCH AND DEVELOPMENT PROGRAM WITHIN THE ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION. Wolfe, R. A.; Ramsey, R. W. Jr. (Energy Research and Development Administration, Washington, DC). Trans. Am. Nucl. Soc.; 21: 246(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12255 SHIELDING ANALYSIS OF THE RETRIEVABLE SURFACE STORAGE FACILITY. Zimmerman, M. G. (Battelle Pacific Northwest Labs., Richland, WA). Trans. Am. Nucl. Soc.; 21: 263-264(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12256 MAXEY FLATS NUCLEAR WASTE BURIAL SITE: INVENTORY. Gat, U. (Oak Ridge National Lab., TN); Thomas, J. D.; Clark, D. T. Trans. Am. Nucl. Soc.; 21: 265-266(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12257 MANAGEMENT OF RADIOACTIVE WASTE. Pittman, F. K. (Atomic Energy Commission, Washington, DC). Water, Air Soil Pollut.; 4: No. 2, 215-219(May 1975).

The safe management of the solid radioactive waste material generated by the various operations that make up the rapidly growing nuclear electric power industry, the nuclear reactors themselves, and the plants which provide new fuel for these reactors and process the spent fuel which results from reactor operations are discussed. (NL)

Handling Equipment and Procedures

Refer also to abstract 11248.

12258 SAFETY ANALYSIS OF THE TRANSPORTATION OF HIGH-LEVEL RADIOACTIVE WASTE. Murphy, E. S.; Winegardner, W. K. (Brookhaven National Lab., Upton, NY). Trans. Am. Nucl. Soc.; 21: 127-128(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12259 CRITICALITY OF Pu-U NITRATE SOLUTION CONTAINING GLASS RASCHIG RINGS. Lloyd, R. C.; Clayton, E. D. (Battelle Pacific Northwest Labs., Richland, WA). Trans. Am. Nucl. Soc.; 21: 236-237(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12260 CRITICALITY IMPLICATIONS OF Pu-U CARBIDE AND Pu-U NITRIDE FUEL MIXTURES. Bierman, S. R.; Howes, B. W.; Clayton, E. D. (Battelle Pacific Northwest Labs., Richland, WA). Trans. Am. Nucl. Soc.; 21: 237-238(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

Transportation

12261 (KY-665) SAFETY ANALYSIS REPORT ON THE "PADUCAH TIGER" PROTECTIVE OVERPACK FOR 10 TON CYLINDERS OF URANIUM HEXAFLUORIDE. Stitt, D. H. (Paducah Gaseous Diffusion Plant, Ky. (USA)). 16 Jun 1975. Contract W 7405-eng-26. vp. Dep. NTIS $7.60.

The "Paducah Tiger" is a protective overpack used in shipment of 10-ton cylinders of enriched UF_6. The calculations and tests are described which made and which indicate that the overpack is in compliance with the type B packaging requirements of ERDA Manual Chapter 0529 and Title 10 Code of Federal Regulations Part 71. (auth)

12262 (MLM-2228) CERTIFICATION OF ERDA CONTRACTORS' PACKAGING WITH RESPECT TO COMPLIANCE WITH DOT SPECIFICATION 7A PERFORMANCE REQUIREMENTS. Edling, D. A.; Griffin, J. F.; (Mound Lab., Miamisburg, Ohio (USA)). 12 Jun 1975. Contract AT-33-1-GEN-53. 143p. Dep. NTIS $5.45.

The purpose of this study was to have one ERDA contractor: (1) compile a list of specification packagings, proposed by ERDA contractors, for shipping Type A quantities of radioactive material, and (2) analyze these packages for conformance to Specification 7A requirements. This study was divided into two phases. Phase I provides a report on those packages which could be shown, based on existing test data and engineering analyses, to conform to DOT Specification 7A packaging requirements. The results of Phase I are discussed in detail in the publication, "Certification of AEC Contractor's Packagings With Respect to Compliance with DOT Specification 7A Performance Requirements – Phase I Summary Report," D. A. Edling, H. E. Meyer and G. L. Phillabaum (Schedule 189C, May 26, 1974). The objectives of Phase II were: (1) identification of packages from Phase I for which available information was not adequate for certification. (Those specification containers used by ERDA contractors and those containers for which adequate information was available for certification are listed in the Phase I summary report.); (2) identification of specific test/engineering analysis data required; (3) generation/procurement of these data; and (4) documentation of study results for use by all ERDA contractors and private industry. The results of Phase II of the study are presented. (TFD)

12263 RADIOACTIVE SUBSTANCES. Class IVb. (Dept. of the Environment, London). pp 167-201 of International Regulations Concerning the Carriage of Dangerous Goods By Rail (RID). London; Her Majesty Stationery Office (1975).

The regulations are contained in sections entitled: introductory notes; list of substances; conditions of carriage packages (general conditions for packing, packing of individual substances, mixed packing, marking and danger labels on the packages); method of dispatch, restrictions on forwarding; particulars in the consignment note; transport equipment (conditions relating to wagons and their loading, marking and danger labels on wagons and on small containers); prohibitions on mixed loading; empty packagings; and other regulations. (UK)

12264 IMPROVEMENTS IN PACKING-CASES FOR CONFINING AND TRANSPORTING RADIOACTIVE MATERIALS. (to Robatel-S.L.P.I.). French Patent 2,208,165/A/. 28 Nov 1972. 9p. (In French).

The fire-proof protection provided between the shield and the outer envelope comprises two series of spaced metal fins between which are provided masses of endothermic insulators. The two rings are held by the two annular sealing layers. The exhaust of the heat generated by the radioactive substance is thus ensured under the best conditions, whereas, should a fire break out about the packing case, the insulator, the radial extent of which can be made as large as desired, constitutes an efficient thermal barrier. (FR)

12265 PROTECTION OF PLUTONIUM IN TRANSIT. McCorkle, G. (Nuclear Regulatory Commission, Washington, DC). Trans. Am. Nucl. Soc.; 21: 250(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12266 DYNAMIC MODELING OF LEAD SLUMP IN SHIPPING CASK DESIGN. Robinson, R. A.; Basham, S. J. Jr. (Battelle Columbus Labs., OH). Trans. Am. Nucl. Soc.; 21: 255-256 (Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12267 CODE OF PRACTICE FOR THE CARRIAGE OF RADIOACTIVE MATERIALS BY ROAD. London; Her Majesty's Stationery Office (1975). 88p.

The Regulations (Radioactive Substances (Carriage by Road) (Great Britain) Regulations, 1974: Section 5 (2), Radioactive Substances Act, 1948) governing the carriage of radioactive materials by road are amplified and revised, conforming to the 1973 edition of the IAEA regulations for the safe transport of radioactive material. Northern Ireland is excluded from the provisions of these Regulations, but the Code may be used for guidance in the appropriate circumstances. The Code is intended to provide all concerned, and consignors in particular, with a detailed and proper standard by which to determine their course of action in order to discharge their obligations under the Law. References are made to additional Regulations which may apply. (UK)

12268 TRANSPORTATION OF RADIOACTIVE MATERIAL BY PASSENGER AIRCRAFT. Report No. 1 of the Special Panel to Study Transportation of Nuclear Materials to the Joint Committee on Atomic Energy, Congress of the United States, Ninety-Third Congress, Second Session, September 17, 1974. Washington, DC; Joint Committee on Atomic Energy (1974). 30p. GPO $0.45.

The findings and recommendations of a panel formed to study the hazards associated with transportation of radioactive materials on passenger planes are presented. (TFD)

PARTICLE ACCELERATORS

Design, Development, and Operation

Refer also to abstract 12727.

12269 (GSI-PB-3-74) UNILAC: PROJECT REPORT NO. 13. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (F. R. Germany)). Oct 1974. 30p. (In German). INIS.

The status report (April-June 1974) of the ion accelerator UNILAC of the GSI, Darmstadt (FRG) gives a review on the work in the following fields: Ion sources, beam injector, beam optics at the accelerator as well as in the stripper and experimentation hall, HF supply and accelerator structures, system controls/electronics (process computer, beam diagnosis, data technique), electrotechnique and construction technique as well as assembly. There are three additional reports: State of the experimental preparation in the experimental hall (production and investigation of nuclides, spectroscopy of charged particles, in-beam gamma and beta-spectroscopy), a beam emittance measuring device at the UNILAC, finally a review on the state and planning of the ion source development for the UNILAC. (GE)

12270 (GSI-PB-4-74) UNILAC: PROJECT REPORT NO. 14. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (F. R. Germany)). Dec 1974. 41p. (In German). INIS.

After a status report for July to September 1974 the Stripperhall of the UNILAC accelerator in its present state and experimental preparation is discussed. Furthermore, charge changing cross sections for Ar- and Kr-ions in He, N_2 and Ar at 160-720 keV are discussed and resulting injection losses in UNILAC are given. The report deals with pulse generators (20 kV) for a beam chopper, the rf-system for the Wideroee-structure, the rf-phase synchronizing system and phase stability of the resonators and the application of an IBM 370-168 computer at GSI. (GE)

12271 PARTICLE ACCELERATION BY STRONG WAVES IN IONIZED MEDIA. Ferrari, A.; Trussoni, E. (Consiglio Nazionale delle Ricerche, Turin (Italy). Lab. di Cosmo-Geofisica). Phys. Lett., A; 51: No. 5, 304-306(24 Mar 1975).

Numerical results on charge acceleration by strong spherical waves propagating through ionized media are presented. Relevant effects of radiation reactions are found which can be of interest in pulsar models. (auth)

12272 PHASE-FREE ACCELERATION OF CHARGED PARTICLES BY AC FIELDS USING A RECTANGULAR DRIFT-TUBE-LOADED CAVITY. Zinner, H.; Schott, W.; Wilhelm, W. (Technische Univ. Muenchen, Garching (F. R. Germany). Physik-Dept.). Nucl. Instrum. Methods; 125: No. 1, 67-71(15 Mar 1975).

By means of a rectangular drift-tube-loaded cavity which resonates in the TE-101 mode, charged particles can be accelerated without a fixed phase relation between the ac fields of the cavity and the phases of entrance of the particles into the fields. The fields in the first half of the cavity are thereby shielded by a drift tube. Operating the cavity with an amplitude of the electromagnetic field of 1.6 G the time-averaged energy gain of electrons with an incident energy of 20 keV was measured to be (15 ± 2) eV. At all phases energy gains were measured. The maximum deviations of the energy-gain values from the time-average are ± 3.6 eV. The data are in good agreement with the theory. (auth)

12273 THALIE. A Flash X-Ray Generator. Freytag, J. P. (Compagnie Generale de Radiologie, 75- Paris (France)). Rev. Tech. Thomson-CSF.; 6: No. 3, 799-817(Sep 1974). (In French).

A flash X-ray generator is designed to produce a very high X dose rate. It can be used for instance to X-ray parts in rapid motion in order to study the behavior of certain electronic components under X-ray radiations or to produce very high density electron beams (higher than 100,000 A). It is pointed out that operation of the tube requires a specific power supply having a low internal impedance and a short length pulse. Operation of the main generator parts is described: Marx, Blumlein and the electron accelerator tube. After the essential features of THALIE have been described the outputs obtained to date are indicated: maximum dose 3500 R at 1 meter, dose rate 5×10^{10} Rs^{-1} at 1 m; routine operation dose: 2000 R at 1 meter, dose rate 2.85×10^{10} Rs^{-1} at 1 m. (FR)

12274 COLLECTIVE ACCELERATION OF IONS BY RELATIVISTIC ELECTRON RINGS. Schumacher, U.; Andelfinger, C.; Ulrich, M. (Max-Planck-Institut fuer Plasmaphysik, Garching; Muenchen (F. R. Germany)). Phys. Lett., A; 51: No. 6, 367-369(7 Apr 1975).

The collective acceleration of hydrogen and helium ions by relativistic electron rings has been successful, using a very fast ring compression, and has clearly been demonstrated by the inertia of the loaded rings and by nuclear track recording. (auth)

12275 LOW-ENERGY ELECTRON ACCELERATOR AS AN INTERDISCIPLINARY UNIVERSITY LABORATORY FOR RADIATION APPLICATIONS. Gozani, T. (Intelcom Rad Tech., San Diego, CA). pp 25-46 of Radiation Engineering in the Academic Curriculum. Vienna; International Atomic Energy Agency (1975).

From proceedings of a study group on radiation engineering in the academic curriculum; Haifa, Israel (27 Aug 1973). See STI/PUB-372; CONF-730866-.

There are two motivations for establishing a new concept of an applied nuclear science laboratory within the framework of a university. The first is the important role nuclear methods can play in modern technology, and the second is the importance of teaching applied nuclear sciences as a tool for broadening the outlook of today's engineers and scientists. These basic motivations establish several ground rules for a desirable laboratory, the first of which is that the laboratory should be interdisciplinary. In applying the ground rules, it is shown that an electron accelerator can best serve as a central tool in the proposed laboratory because it is highly versatile and can easily furnish the three types of radiation, electrons, high-energy x-rays, and variable energy neutrons. Among the available types of electron accelerators, the selection, in this study, falls on the circular electron accelerator of the microtron type. This choice is based on the high quality of the electron beam, its relative simplicity and its cost. A tentative list of 19 applications in the fields of research and development and instruction has been compiled, along with the accelerator performance for each application. General specifications and estimated cost for a reasonably powerful low-energy microtron are also given. The proper implementation of the research programme outlined in the paper requires the support of adequate undergraduate and post-graduate programmes. A minimum effective programme would involve the last two years of the undergraduate studies and would have a complete post-graduate programme. Optional courses can be tailored to the specific capabilities and requirements of the particular institution, local industry, community, and country. The scope of the proposed laboratory can be broadened by incorporating in it the study of uses of isotopic gamma and neutron sources such as ^{60}Co, ^{137}Cs and ^{252}Cf. This is a natural extension of the activities since many industrial applications of the nuclear technology are based on using these sources or similar ones. (auth)

12276 NUCLEAR ACCELERATORS IN INDUSTRY AND MEDICINE. Rose, B. (AERE, Harwell, Eng.). pp 47-61 of Radiation Engineering in the Academic Curriculum. Vienna; International Atomic Energy Agency (1975).

From proceedings of a study group on radiation engineering in the academic curriculum; Haifa, Israel (27 Aug 1973). See STI/PUB-372; CONF-730866-.

A general survey is given of the application of various types of accelerator to industrial, analytical and medical problems. From this survey, though incomplete, two sets of topics are drawn up relating to the educational requirements for adequate understanding of accelerators themselves and of various applications. These two sets of topics roughly correspond to classical physics on the one hand and atomic and nuclear physics on the other. It is believed that the list of educational topics is not much affected by the necessarily limited survey of the field. (auth)

Auxiliaries and Components

12277 AN ANALOG COMPUTER FOR CALCULATING THE SHUNT IMPEDANCE OF A RESONANT CAVITY. Shipley, J. P.; Dooley, G. R. Jr. (Los Alamos Scientific Lab., N. Mex. (USA)). Nucl. Instrum. Methods; 125: No. 1, 173-176(15 Mar 1975).

A small, special-purpose analog computer has been developed for automatically calculating the shunt impedance of a resonant cavity from phase-shift perturbation data. Accuracy is limited by the size of the perturbing bead and precision is about 2% for a fixed experimental configuration. (auth)

12278 LV POWER TRANSFER SYSTEM IN A PLANT BROUGHT TO A VERY HIGH POTENTIAL. Martin, J.; Roux, J. (Lyon-1 Univ., 69- Villeurbanne (France). Inst. de Physique Nucleaire). Rev. Gen. Electr.; 83: No. 10, 673-678(Oct 1974). (In French).

Confronted with the difficulties involved by L. V. power feeding of platforms brought to very high voltages in the air (about one

megavolt), the authors, after having recalled the conventional solution of isolating shafts and noted their draw-backs, explain the principle of a power transfer system using a succession of series-connected and auto-connected high insulation transformers. All the units being identical, the standard exchange in case of failure can take place immediately. The solutions adopted at the time of the development of a prototype unit of 100 kVA under 220 V ac, with 200 kV dc insulation, will give the performance data and results obtained. (FR)

12279 SHIELDING CALCULATIONS FOR A 200-MeV PROTON ACCELERATOR AND COMPARISONS WITH EXPERIMENTAL DATA. Alsmiller, R. G. Jr.; Santoro, R. T.; Barish, S. J. (Oak Ridge National Lab., TN). Trans. Am. Nucl. Soc.; 21: 546-547 (Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

Ion Sources and Injection and Extraction Systems

12280 (RL-75-035) 70-MeV INJECTOR ALIGNMENT PROPOSALS. Part 4. HEDS Alignment. Lascelles, R. (Science Research Council, Chilton (UK). Rutherford Lab.). Mar 1975. 8p. Dep. NTIS (US Sales Only) $4.00.

Proposals are made for alignment of the components in the high-energy drift space of the new 70-MeV injector for NIMROD. (UK)

Storage Rings

12281 STOCHASTIC COOLING OF A STORED PROTON BEAM. Bramham, P.; Carron, G.; Hereward, H. G.; Huebner, K.; Schnell, W.; Thorndahl, L. (European Organization for Nuclear Research, Geneva (Switzerland)). Nucl. Instrum. Methods; 125: No. 1, 201-202(15 Mar 1975).

A setup to damp the incoherent betatron oscillations of the particles in a coasting beam is described. First experimental results obtained in the CERN Intersecting Storage Rings (ISR) are presented. (auth)

Experimental Facilities

Refer also to abstracts 11614 and 12273.

12282 A TIME-DEPENDENT ANALYSIS OF ASYMMETRY MEASUREMENTS IN POLARIZED-TARGET EXPERIMENTS. Chabaud, V. (European Organization for Nuclear Research, Geneva (Switzerland)); Kuroda, K. (Paris-11 Univ., 91-Orsay (France). Inst. de Physique Nucleaire). Nucl. Instrum. Methods; 125: No. 1, 119-124(15 Mar 1975).

A least-squares method has been developed for treating the problem of time-dependent fluctuations of counting rates in polarized-target experiments. The method was applied to an analysis of asymmetry measurements in some inclusive reactions. The effect of the systematic fluctuation on the total error of asymmetry is much smaller than that one might expect from a simple quadratic sum of statistic and systematic errors. Some tests using the experimental data revealed that the method provides a kind of suppressing effect of the bias in asymmetry measurements due to the fluctuations of counting rates. (auth)

12283 A RAPID ON-LINE SEPARATION SYSTEM EMPLOYING HELIUM-JET TRANSPORT SYSTEM AND CENTRIFUGE. Hellmuth, K. H.; Valli, K. (Jyvaeskylae Univ. (Finland). Dept. of Physics). Nucl. Instrum. Methods; 125: No. 1, 99-104(15 Mar 1975). (In German).

A centrifuge for continuous liquid-liquid phase separation is described. It is designed for rapid solvent extraction of short-lived radioactive isotopes (half-lives in the order of seconds). The centrifuge is characterized by simple construction and operation principle, easy handling, low cost, and a minimum hold-up time of less than five seconds (phase purity 99.0 to 99.9%). The on-line connection to a helium-jet transport system is described. Problems concerning the transfer of activities into a liquid phase from the helium-jet at atmospheric pressure are discussed. (auth)

12284 PREPARATION OF A THICK ^{14}C TARGET. Cabot, M. A.; Galonsky, A.; Doering, R. R. (Michigan State Univ., East Lansing (USA). Cyclotron Lab.); Costanzo, J. (Action Plastic, Charlotte, Michigan 48813, USA). Nucl. Instrum. Methods; 125: No. 1, 85-88(15 Mar 1975).

A high-temperature epoxy was mixed with ^{14}C powdered graphite and baked at 225°C. The resulting wafer had a ^{14}C thickness of 3.5 mg/cm^2 and was used for $^{14}C(p,n)^{14}N$ measurements with micro-ampere beams from the isochronous cyclotron. (auth)

12285 SEARCH FOR A POLARIZED LITHIUM TARGET. Ebinghaus, H.; Steffens, E.; Ulbricht, J.; Wittchow, F. (Hamburg Univ. (F. R. Germany). 1. Inst. fuer Experimentalphysik). Nucl. Instrum. Methods; 125: No. 1, 73-78(15 Mar 1975).

Measurements of the remaining polarization of polarized lithium atoms condensed on copper, silver, and teflon, and of polarized lithium ions implanted into CaF_2 and NaCl show that the relaxation times are too small to generate a polarized lithium target by these methods. Furthermore, the penetration depths of lithium ions in CaF_2 and NaCl were investigated by using a nuclear reaction. (auth)

12286 THE SYNCHROTRON RADIATION IN FRANCE: THE CURRENT FACILITIES AND EXPERIMENTS AND THE FUTURE DEVELOPMENTS. Dagneaux, P.; Pinchaux, R.; Thiry, P. (Paris-6 Univ., 75 (France). Lab. de Physique des Solides); Depautex, C.; Morel, G. (Laboratoire pour l'Utilisation du Rayonnement Electromagnetique (LURE), Paris-11 Univ., 91-Orsay (France)); Dbez, P.; Durup, J.; Farge, Y.; Wuilleumier, F. (Paris-11 Univ., 91- Orsay (France)); Fourme, R. (Paris-12 Univ., 94- Creteil (France)). Ann. Phys. (Paris); 9: No. 1, 9-65 (Jan 1975). (In French).

L.U.R.E., laboratory jointly sponsored by the C.N.R.S. and the Paris-sud University, was created for use of the synchrotron radiation emitted by the Orsay electron storage rings (ACO and DCI). The characteristics of this synchrotron radiation are described and the main interests in the use of this radiation in numerous fields are briefly presented. The facilities allowing for the production and the monochromatization of the light emitted by ACO are described, as well as various experiments already in operation. The research projects planned with the new ring DCI, currently in construction, are enumerated. The scientific possibilities provided by the use of these two machines are presented. (FR)

12287 ULTRA-FAST CHEMICAL SEPARATIONS ("PLASMA CHEMISTRY") WITH A RECOIL-TRANSPORT SYSTEM. Kosanke, K. L.; Edmiston, M. D.; Warner, R. A.; McHarris, W. C.; Slaughter, M. F.; Kelly, W. H. (Michigan State Univ., East Lansing (USA). Cyclotron Lab.). Nucl. Instrum. Methods; 125: No. 2, 253-256(1 Apr 1975).

The transport efficiency through a long-capillary He-jet recoil-transport system can be changed for different elements by altering the nature and/or the concentration of the impurities in the He. Thus, it appears that a form of "plasma chemistry" is taking place in the formation of the "macromolecules" that transport the radioactive recoils through the system and the attachment of the recoils to chemically specific sites on these macromolecules. Some experimental results are described and the advantages of such a system are pointed out; also, it is noted that it is possible to obtain information about the Z of a nuclide from these experiments. (auth)

12288 ELLIPSOIDAL AND BENT CYLINDRICAL CONDENSING MIRRORS FOR SYNCHROTRON RADIATION. Howell, J. A.; Horowitz, P. (Harvard Univ., Cambridge, Mass. (USA). Lyman Lab. of Physics). Nucl. Instrum. Methods; 125: No. 2, 225-230 (1 Apr 1975).

A simple description is given of the intensity profile of X-rays reflected at glancing incidence from an ellipsoidal or bent cylindrical condensing mirror. Results obtained with a quartz mirror at the Cambridge Electron Accelerator are shown. (auth)

12289 PHYSICS (AND TECHNIQUE) OF GAS JET EXPERIMENTS. Melissinos, A. C.; Olsen, S. L. (Rochester Univ., N. Y. (USA). Dept. of Physics and Astronomy). Phys. Rep.; 17: No. 3, 77-132 (Apr 1975).

63 refs.

Recently, gas jet targets have been used for the study of small momentum transfer p-p and p-d elastic and inelastic scattering. In these experiments, which were performed at Serpukhov in the USSR and at the Fermilab in the USA, the gas jet is introduced in the main ring of the accelerator. The techniques associated with these measurements are reviewed; and the published results, which cover 4-momentum transfers $0.001 < |t| < 0.12$ (GeV/c)$^{-2}$ and incident energies $8 < E < 400$ GeV, are summarized. Elastic scattering data have yielded precise values for the slope of the nuclear scattering amplitude and for the ratio of the real to imaginary part as a function of energy. The implications of these data on the understanding of high-energy hadronic interactions are discussed in some detail. Information on the diffractive dissociation of the proton to low-mass states, obtained from

inelastic scattering using the gas jet target, is also presented and discussed. (auth)

12290 ELAPSED TIME IN He-JET SYSTEMS WITH LONG CAPILLARIES. Weiffenbach, C.; Gujrathi, S. C.; Lee, J. K. P.; Houdayer, A. (McGill Univ., Montreal, Quebec (Canada). Foster Radiation Lab.). Nucl. Instrum. Methods; 125: No. 2, 245-251(1 Apr 1975).

A helium-jet recoil-transport system with a 10 m capillary has been developed for the study of short-lived radioactive nuclides produced by cyclotron internal-beam bombardments. The dependence of the speed of the gas and the time spent by the activity in the capillary have been studied by varying parameters of the system such as dimension of the capillary and pressure in the target chamber. Simple equations based on known gasdynamical properties are compared with the experimental observations. A reasonable agreement between theory and experiment demonstrates the usefulness of the theoretical expressions in optimizing the desired system parameters. (auth)

12291 DEVELOPMENT OF SPECIAL TARGETS FOR TAILORED FAST-NEUTRON SOURCES. Bates, A. L.; Malaviya, B. K. (Rensselaer Polytechnic Inst., Troy, NY). Trans. Am. Nucl. Soc.; 21: 504-505(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

PHYSICS (ASTROPHYSICS AND COSMOLOGY)

Cosmic Radiation

12292 INFLUENCE OF LONG TERM SOLAR MODULATION ON THE RELATIVISTIC MUON INTENSITY. Bhattacharyya, D. P. (Indian Association for Cultivation of Science, Calcutta). J. Phys., A (London); 7: No. 18, 2333-2338(11 Dec 1974).

During the period 1965 to 1971 a set of absolute muon intensity data available at stations having low vertical cut-off rigidities shows a small disagreement with latitude corrected muon intensity obtained by the author (Bhattacharyya, Z. Phys.; 234: 17-22 (1970) and J. Phys. Soc. Japan; 37: 293-8 (1974)) and this could possibly be due to the maximum increase in the Zurich sunspot number which intensifies the electric tension of Earth, ie the Ehmert potential. The decrease of muon intensity at around 1 GeV/c during the years 1965 to 1969 is in accord with the theoretical results calculated after O'Brien (2nd Int. Symp. on Natural Radiation Environment, Houston, Texas. (1972)) when multiplied by a factor 1.085 but lies below the theoretical values calculated after Allkofer and Dau (Acta Phys. Akad. Sci. Hung.; 29 Suppl 2: 611-8 (1970)). The decrease of muon intensity is in agreement with the Deep River integral muon intensity data during the same period. (auth)

12293 COSMIC RAYS AND THE GALAXY. Hillas, A. M.; Ouldridge, M. (Univ. of Leeds, Eng.). Nature (London); 253: No. 5493, 609-610(20 Feb 1975).

It is stated that although evidence on whether or not most of the detected cosmic rays originate in the Galaxy is inconclusive and involves uncertainties, a galactic origin seems to offer a more probable interpretation that an extragalactic origin. Near isotropy has hitherto been the discordant feature, but recent studies suggest that the arrival directions of the most energetic cosmic rays are almost certainly highly anisotropic. The existence and implications of a very extensive ordered magnetic field outside the plane of the Galaxy are discussed. (UK)

12294 COSMIC GAMMA-RAY BURSTS. Fabian, A.; Pringle, J. (Cambridge Univ., Eng.). New Sci.; 65: No. 935, 313-315 (6 Feb 1975).

Recently short bursts of γ rays have been observed from a number of space observatories which last for only about 10 sec., do not recur and do not have any steady components. The number of such sightings is small but it would appear that the sources of the bursts were at least as far away as the edge of the solar system and probably much more distant. The total energy emitted by the sources must be about 10^{33} ergs multiplied by the square of the distance to the source in parsecs (the Sun emits 4×10^{33} ergs per second). The energy spectrum of the events can be traced from x-rays of 5 keV up to gamma rays of several MeV. The overall spectrum is uncertain, but it is compatible with that expected from an optically thin gas at a temperature of about 1000 million K. It is usual to assume that the origin of the bursts is either distant and extra-galactic or close by in our own Galaxy. Ideas for extragalactic sources include the early stages of radio outbursts in quasars, and shock waves in supernovae. A number of the exponents of theories involving nearby sources favor neutron stars both to produce the energy needed and to account for the short time scale. Among the other hypotheses suggested here is that the events are due to collisions between chunks of antimatter and stars. It is to be hoped that the rate of discovery of new bursts exceeds the rate of production of new theories. (UK)

12295 COOLING RATES OF ORDINARY CHONDRITES FROM FISSION TRACKS OF ^{244}Pu. Pellas, P.; Storzer, D. (Museum National d'Histoire Naturelle, 75- Paris (France)). C. R., Ser. D.; 280: No. 3, 225-228(20 Jan 1975). (In French).

The fission track record from ^{244}Pu registered in whitlockites as well as in olivines and pyroxenes in close contact with the phosphates provides a means of retracing the thermal history of ordinary chondrites within a few hundred million years after their formation (approximately 4.6×10^9 years ago). (FR)

12296 NUMBER OF PROBLEMS IN RELATIVISTIC ASTROPHYSICS. Amnuel, P. R.; Guseinov, O. Kh. (Shemakha Astrophysical Observatory, USSR). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 12, 69-79(1974). (In Russian).

It is pointed out that the fundamental difference of general relativity theory (GRT) from Newtonian gravitational theory is that the gravitational force goes to infinity as the radius approaches zero with Newton's theory, but with GRT the gravitational force can approach infinity at a finite radius of a body. This radius is called the gravitational radius R_g. The closer the radius of a body comes to R_G, the more substantial is the effect of GRT. Such objects occur in relativistic astrophysics, and are called relativistic stars. The properties and structure of relativistic objects found in stellar physics are of interest in confirming the predictions of general relativity theory. A short review is given of the history of discovery and the properties of neutron stars, black holes, supernovae and other relativistic objects. 65 refs. (SJR)

12297 PROPAGATION OF COSMIC RAYS IN THE GALAXY. Daniel, R. R. (Tata Inst. of Fundamental Research, Bombay (India)); Stephens, S. A. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). Space Sci. Rev.; 17: No. 1, 45-158(Feb 1975).

430 refs.

It is evident that, if one is to investigate and deduce useful information from a model in which cosmic rays are generated, propagated and stored in the Galaxy, one would have to make the best use of all available information on the Galaxy, its dimensions and its constituents. In particular, one would need as many data as possible on the interstellar medium and its physical state. All such information of direct concern has, therefore, been judiciously collected and summarized. Since, in this model, the confinement region is adequately circumscribed, one is able to work out a theoretical formulation of the propagation of cosmic rays in the Galaxy. The present theoretical treatment is, however, limited to a situation in which cosmic rays are in a state of equilibrium and are distributed homogeneously in the residence volume. While such a simplified treatment has been forced because of the otherwise intrinsic complexities and difficulties encountered, the assumptions regarding the equilibrium nature of the cosmic rays and its homogeneous distribution in the Galaxy seem to be well founded on the basis of existing knowledge. The observational data on cosmic rays in relation to their propagation in the Galaxy are also examined and interpreted. The fact that cosmic rays traverse a region of cosmic space pervaded by a tenuous gas, weak magnetic fields and radiation fields implies that cosmic rays, which are literally immersed in them, should interact with them in a wide variety of ways. Many of these lead to the production of radiations ranging the entire electromagnetic spectrum—from radio waves to gamma rays. Finally, recent studies in astrophysics have unmistakably highlighted the possible roles that cosmic rays are likely to play in some aspects of galactic dynamics, such as the hydrostatic equilibrium of interstellar gas, gravitational instability and formation of clouds, heating of interstellar gas, etc. Though there is still a long way to go toward a fuller understanding of the propagation of cosmic rays in the Galaxy and its implications, it can already be seen that much progress has been achieved, particularly during the last decade or so. (auth)

12298 CONFINEMENT OF GALACTIC COSMIC RAYS BY ALFVEN WAVES. Holmes, J. A. (Oxford Univ.). Mon. Notic. Roy. Astron. Soc.; 170: No. 2, 251-260(Feb 1975).

A leaky-box model of cosmic-ray confinement is investigated in an axially-symmetric model of the Galaxy. The cosmic rays are confined by the Alfvén waves which they excite in the magnetic field. The effect of nonlinear damping of the Alfvén waves is discussed, and the residence time and path length of cosmic rays in the Galaxy are calculated as functions of rigidity. Observations of the electron spectrum and of pulsar scintillation are discussed in terms of this model. (auth)

Stars

Refer also to abstracts 12428, 12457, 12636, 13006, and 13008.

12299 (AD-784439) INFRARED, RADIO, AND X-RAY OBSERVATIONS OF CYGNUS X-3. Report for June-October 1973. Becklin, E. E.; Neugebauer, G.; Wynn-Williams, C. G.; Hawkins, F. J.; Matthews, K. (Hale Observatories, Pasadena, Calif. (USA); California Inst. of Tech., Pasadena (USA); Owens Valley Radio Observatory, Pasadena, Calif. (USA)). 1974. 25p. NTIS $3.00.

The x-ray source cygnus X-3 was interpreted as being a binary system on the basis of extensive x-ray observations of periodic variability. At radio wavelengths, the source displays erratic outbursts. Cyg x-3 was not detected visually but at infrared wavelengths periodic variations in phase with the x-ray variations were reported. Infrared, x-ray, and radio observations of cyg x-3 made during 1973 through October 1973 are presented. (auth)

12300 (INIS-mf-1390) ROCKET-BORNE SOFT X-RAY OBSERVATION OF Sco X-1. Deerenberg, A. J. (Rijksuniversiteit Leiden (Netherlands)). 29 Jun 1973. 72p. INIS.

The astronomical importance of soft x-ray observations was outlined. The luminosity of the celestial ¼ keV background is much higher than was predicted by an extrapolation of the luminosity of the diffuse x-ray sky at higher energies. A detailed sky survey of the ¼ keV background may help to explain whether the excessive radiation is of galactic or extragalactic origin. Knowledge of the existence of low temperature x-ray sources yields clues with respect to a possible contribution of these sources to the ¼ keV background. The absorption profile of the soft x-ray spectrum of a celestial source contains information on the distance of the source, the knowledge of which bears implications on the distribution of the x-ray sources. With these objectives in mind the Cosmic Ray Working Group at Leiden (the Netherlands) and the Space Physics Laboratory at Nagoya (Japan) decided in 1969 to start a series of joint rocket-borne soft x-ray experiments. The first experiment, called LEINAX I, was launched on 26 May, 1971, and the second experiment, LEINAX II, on 23 May, 1972. LEINAX I yielded spectra of the Cygnus Loop, Cyg X-2, Sco X-1, and several sources in the galactic center region. A new soft x-ray source was discovered near λ-Sco, and maps of part of the diffuse x-ray sky were constructed for three different energy intervals. A discussion is given of the observation of Sco X-1, preceded by an extensive description of the LEINAX I experiment. The LEINAX I experiment observed for Sco X-1 an absorption measure of $n_H = 6(-1, +2) \times 10^{20}$ H atoms cm^{-2} absorbing material along the line of sight, and LEINAX II yielded a value of $n_H = 12(-3, +6) \times 10^{20}$ H atoms cm^{-2}. Although the n_H values differ by a factor 2, the statistics involved were too poor to state that the x-ray absorption measure of Sco X-1 is variable in time. Other observers, using less sensitive experiments, obtained n_H values up to 50×10^{20} H atoms cm^{-2}. Since it is not likely, that the high values are only caused by the smaller x-ray sensitivities of these experiments, one cannot exclude the existence of a circumstellar cloud, of which the opacity for x-rays is variable in time. In any case the interstellar absorption of Sco X-1 is not greater than $n_H = 6(-1, +2)$ H atoms cm^{-2}. The LEINAX I experiment was executed with a set of 12 independent x-ray telescopes, mounted aboard a spinning rocket payload. The detectors of the telescopes were equipped with either 1 m or 5 m thick polypropylene entrance windows. The thin window films reached high detection efficiencies of 78% (1 -telescopes) and 35% (5 -telescopes) at an energy of 278 eV for the experiment, for which the energy range was set from 160 eV to 7 keV. In flight two major problems were encountered, apart from some minor ones, both of which impaired the observation of diffuse x-ray below 300 eV. Firstly, the electrostatic deflection system, which was incorporated to reject a possible contamination by electrons of the observations, malfunctioned, which resulted in an enhanced background. Secondly, the counters showed an appreciable uv-sensitivity, which differed from counter to counter. The uv-sensitivity of the counters does not affect the data of discrete sources, but requires further study before the analysis of the diffuse x-ray sky at energies below 300 eV can be completed. (auth)

12301 (ORO-3992-207) RELATIVISTIC SUPERDENSE MATTER IN COLD SYSTEMS. Bowers, R. L.; Gleeson, A. M.; Pedigo, R. D. (Texas Univ., Austin (USA). Center for Particle Theory). 1975. Contract AT(40-1)-3992. 93p. (CPT-251). Dep. NTIS $7.75.

The fully relativistic model of the strong interactions between hyperons, fitted to nuclear matter, is used to investigate the properties of superdense matter. This model can be solved exactly, and the low temperature limit applied directly to construct neutron star models. The results predict a significantly higher mass stability limit (M/sub max/ equals 2.39M/sub mass/) which has far reaching implications for black hole astrophysics. It also predicts moments of inertia well above the observational lower bounds for pulsars. The model predicts a phase transition which includes nuclear densities, and has significant implications for the detailed structure of neutron stars. Despite the low central densities found for stable masses (epsilon/sub C/ less than or approximate to 2 x 10^{15} g/cm^3) all members of the first SU(3) symmetric octet except the Ξ^- enter as stable constituents. In addition, quarks may be used as fundamental constituents for a species of superdense matter applicable to models of the hyperons. The results indicate that this approach may be fruitful in explaining such phenomena as precocious scaling and quark confinement. (auth)

12302 (RL-75-009, pp VII.1-VII.18) PULSARS AND QUASARS. Palmer, H. P. (Nuffield Radio Astronomy Labs., Jodrell Bank, Eng.). 1975.

In proceedings of the 1974 school for young high energy physicists.

The lecture described the instruments used in radioastronomy and the sensitivity and resolution of present measurements. An account is given of the discovery of pulsars and of current observations of these objects. The properties of quasars and radio galaxies are summarized. (UK)

12303 FORMATION OF MOLECULAR LINES IN STELLAR ATMOSPHERES. Hinkle, K. H.; Lambert, D. L. (Texas Univ., Austin). Mon. Notic. Roy. Astron. Soc.; 170: No. 3, 447–474 (Mar 1975).

Statistical equilibrium of electronic states of diatomic molecules in stellar atmospheres is examined. Atmospheres discussed are representative of the Sun, Arcturus (K-giant), and Betelgeuse (M-supergiant). A comparison of the relative collisional and radiative contributions to the equilibrium of the ground electronic state shows that this state is collisionally controlled and that the line source function for vibration–rotation transitions within this state is equivalent to the Planck function. Examination of the equilibrium for excited electronic states demonstrates that the exchange between these states and the ground electronic state is most probably determined by radiative excitation. This result implies that scattering rather than pure absorption is the appropriate mechanism for the formation of lines belonging to these electronic transitions. The scattering hypothesis is given a preliminary check against solar observations. Areas for future investigations are outlined. (auth)

12304 HIGH RESOLUTION OBSERVATIONS OF PLANETARY NEBULAE AT 5 GHz. Scott, P. F. (Cambridge Univ., Eng.). Mon. Notic. Roy. Astron. Soc.; 170: No. 3, 487–495(Mar 1975).

Five planetary nebulae have been observed at a frequency of 5 GHz with 2″ arc resolution. For two of the nebulae, NGC 6543 and NGC 7662, the radio structures are well determined and closely resemble those found optically. The radio spectra imply hydrogen temperatures ~6000 K. An alternative classification of the nebula M 1-78 as a compact H II region is discussed briefly. (auth)

12305 X RAYS PREDICTED FROM FLARES OF UV CETI STARS. Crannell, C. J.; McClintock, J. E.; Moffett, T. J. (Massachusetts Inst. of Tech., Cambridge). Nature (London); 252: No. 5485, 659-661(20 Dec 1974).

It is stated that UV Ceti flare stars are all located within 20pc of the Sun, and appear to have an isotropic distribution; they are cool, low-luminosity objects with masses ~ $0.5M_\odot$. Optical and radio radiation has been observed during flare events, and x rays have been predicted but no positive observations have been reported. New estimates of x-ray emission are here presented, based on the ratio between x-ray and radio flux from solar bursts. It is estimated that the intensities of the x-ray emissions will be >10 photons/cm^2/sec. for a flare duration of 3 min. in the energy range 1 to 10 keV, and within the range of sensitivities of present satellite detectors. (UK)

12306 LINE SPLITTING ACROSS THE MASSIVE NEUTRAL INTRUSIONS IN M16. Elliott, K. H.; Meaburn, J. (Univ. of Manchester, Eng.). Mon. Notic. Roy. Astron. Soc.; 170: No. 2, 237-239(Feb 1975).

Variable splitting of the [O III] line has been observed over the neutral intrusions in the core of M 16 with a Fabry–Perot monochromator. A simple model is proposed to explain this. (auth)

12307 COLOUR EXCESSES OF THE LONG-PERIOD CEPHEIDS. Schmidt, E. G. (Royal Greenwich Observatory, Hailsham, Eng.). Mon. Notic. Roy. Astron. Soc.; 170: No. 2, 39P-44P(Feb 1975).

Photometric measurements have been made on the uvbyβ system of stars located in the fields near five long-period Cepheids. The interstellar reddening of these field stars is compared with published data for the Cepheids. It appears that for the longest period Cepheids (periods greater than about 15 days) systematic errors exist in the methods of finding colour excesses which seriously affect the pulsational masses. (auth)

12308 STAR FORMATION IN CLOUDS OF MOLECULAR HYDROGEN. Reddish, V. C. (Royal Observatory, Edinburgh). Mon. Notic. Roy. Astron. Soc.; 170: No. 2, 261-280(Feb 1975).

It is shown that the formation of hydrogen molecules on the surfaces of grains in interstellar clouds results in pressure instabilities leading to fragmentation of the clouds and the formation of protostars. The frequency distribution of the masses of stars thus formed (the initial mass function) is determined by the physical properties of interstellar grains and the density distributions in interstellar clouds; it has been calculated and agrees with observation. The rate of star formation is controlled by the rate of cosmic expansion; this has also been calculated and is consistent with observational data. Using the properties

of this process of star formation, together with available data on the evolution of stars, supernovae and supermassive objects and the synthesis of elements and the formation of grains, calculated properties of model galaxies are shown to agree with observation. The evolution of galaxies is controlled by specific negative feedback loops. The properties of elliptical galaxies are found to be due to overshoot in the rate of star formation due to a slightly colder than average initial environment. The calculations contain no free parameters. The results are the inevitable consequence of the physical properties of solid grains, molecule formation and the cosmic expansion. (auth)

12309 TWO KINDS OF STELLAR COLLAPSE. Katz, J. I. (Inst. for Advanced Study, Princeton, NJ). Nature (London); 253: No. 5494, 698-699(27 Feb 1975).

It is shown that the events which produce compact objects may be divided into at least two classes on the basis of the impulse given to a binary system containing the collapsing object. This impulse may be related to the amount and symmetry of mass loss resulting from the collapse event. (UK)

12310 ULTRAVIOLET EMISSION LINES IN THE SPECTRUM OF PROCYON. Evans, R. G.; Jordan, C. (Science Research Council, Abingdon, Eng.). Nature (London); 253: No. 5493, 612-613(20 Feb 1975).

Using the Princeton instrumentation on the satellite Copernicus it is stated that in addition to previously observed MgII lines, the Lyman-α line of HI (1216A) for the resonance lines of SiIII (1206A) and O VI (1032A) were observed for the first time in an F-type star in the spectrum of the F5 IV star Procyon. The observed Lyman-α profile clearly shows a component due to absorption by interstellar atomic H in the line of sight to Procyon. Models are discussed. (UK)

12311 IONIZATION EQUILIBRIUM OF HYDROGEN-LIKE TO ARGON-LIKE IONS OF ELEMENTS. Summers, H. P. (Cambridge Univ., Eng.). Mon. Notic. Roy. Astron. Soc.; 169: No. 3, 663-680(Dec 1974).

Techniques are described by which the calculation of collisional dielectronic recombination and ionization coefficients may be greatly accelerated. The methods are applied to the determination of density dependent ionization equilibria of hydrogen-like to argon-like ions of elements for the case of zero radiation field over wide ranges of electron temperatures and densities. The extension to a wider range of physical conditions is described. Estimates are made of the corrections arising from autoionization and secondary autoionization and results including corrections are expected to be accurate to ~40 per cent. Only a selection of results is presented. (auth)

12312 STELLAR COMPOSITIONS FROM NARROW-BAND PHOTOMETRY. V. Barium Abundances for 200 Evolved Stars. Williams, P. M. (Cambridge Univ., Eng.). Mon. Notic. Roy. Astron. Soc.; 170: No. 2, 343-362(Feb 1975).

Using narrow-band spectrophotometric indices interpreted with synthetic spectra computed from model atmospheres, barium abundances have been measured for 200 stars with uncertainties of about 0.3 in [Ba/H]. The results suggest that there is a continuous distribution of [Ba/Fe] from the Ba II stars to barium poor stars and that the latter, at least, reflect a variation of [Ba/Fe] in the interstellar medium which may be correlated with [Fe/H]. Several possible new Ba II stars have been found and the frequency of Ba II stars amongst G and K giants appears to lie between 1 and 4 per cent. Only one of the candidate Ba II stars appears to have strong CN and CH absorption and the candidates cover a wide range in luminosity. Masses between 0.5 $M_\odot$ and 50 $M_\odot$ were derived for Ba II stars which also have spectroscopic gravities or [Fe] derived in other analyses. Most Ba II stars appear to have young disk kinematics. It is confirmed that the peculiar colors of many Ba II stars are caused by excess blanketing due to CN, CH, and C_2. (auth)

12313 GRAVITY OSCILLATIONS OF WHITE DWARFS. Brickhill, A. J. (Univ. of Cape Town). Mon. Notic. Roy. Astron. Soc.; 170: No. 2, 405-421(Feb 1975).

The second order differential equations governing the non-radial adiabatic oscillations of stars have been solved for a variety of white-dwarf models. It is found that the inclusion of convection in the envelopes of the models with surface temperatures corresponding to those of HL Tau 76 and G44-32 does not alter the eigenvalues significantly and the periods of the lowest order modes are shorter than the observed periods by a factor of about 2. The eigenfunctions of hot white-dwarf models which include a hydrogen burning shell in equilibrium show that the oscillations have a large amplitude only in the hydrogen envelope. The relevance of these results to the observation of periodic variations in cataclysmic variables is discussed. (auth)

12314 LOCATION OF THE HOT SPOT IN CATACLYSMIC VARIABLE STARS AS DETERMINED FROM PARTICLE TRAJECTORIES. Flannery, B. P. (Univ. of California, Santa Cruz). Mon. Notic. Roy. Astron. Soc.; 170: No. 2, 325-331(Feb 1975).

Warner & Peters (Mon. Not. R. Astr. Soc.; 160:15(1972)) using particle trajectories in the restricted three-body approximation, have previously published a set of models for the hot spot location in cataclysmic variable stars. This paper presents a new set of models, based on their assumptions, which corrects an error in their calculations. With the new models the spot radius is moved substantially closer to the blue star for most mass fractions, and other parameters are changed accordingly. It is pointed out that the well-defined picture for the hot spot geometry produced in this model is probably not directly applicable to real stars. (auth)

12315 MACRODYNAMICS OF α-EFFECT DYNAMOS IN ROTATING FLUIDS. Malkus, W. V. R.; Proctor, M. R. E. (Massachusetts Inst. of Tech., Cambridge). J. Fluid Mech.; 67: 417-443(11 Feb 1975).

Past study of the large-scale consequences of forced small-scale motions in electrically conducting fluids has led to the "α-effect" dynamos. Various linear kinematic aspects of these dynamos have been explored, suggesting their value in the interpretation of observed planetary and stellar magnetic fields. However, large-scale magnetic fields with global boundary conditions can not be force free and in general will cause large-scale motions as they grow. In this paper the finite amplitude behavior of global magnetic fields and the large-scale flows induced by them in rotating systems is investigated. In general, viscous and ohmic dissipative mechanisms both play a role in determining the amplitude and structure of the flows and magnetic fields which evolve. In circumstances where ohmic loss is the principal dissipation, it is found that determination of a geostrophic flow is an essential part of the solution of the basic stability problem. Nonlinear aspects of the theory include flow amplitudes which are independent of the rotation and a total magnetic energy which is directly proportional to the rotation. Constant α is the simplest example exhibiting the various dynamic balances of this stabilizing mechanism for planetary dynamos. A detailed analysis is made for this case to determine the initial equilibrium of fields and flows in a rotating sphere. (auth)

12316 EFFECT OF THE $^{12}C/^{13}C$ RATIO OF REPEATED DEEP MIXING TO THE HYDROGEN BURNING SHELL IN A RED GIANT. Dearborn, D. S. (Univ. of Texas, Austin); Bolton, A. J. C.; Eggleton, P. P. Mon. Notic. Roy. Astron. Soc.; 170: No. 1, 7P-10P(Jan 1975).

The effect of thermal instabilities in the hydrogen burning shell on the $^{12}C/^{13}C$ ratio in the envelope is studied. Repeated deep mixing caused by the instability can reduce the $^{12}C/^{13}C$ ratio to values of about 10. This process does not however produce carbon stars. (auth)

12317 OBSERVATIONS OF RAPID BLUE VARIABLES. XV. VW Hydri. Warner, B. (Cape Town Univ.). Mon. Notic. Roy. Astron. Soc.; 170: No. 1, 219-228(Jan 1975).

The Southern Hemisphere dwarf nova VW Hydri is shown, on the basis of repetitive humps in its light curve, to be a binary with a period of 106.95 min. Observations made during two supermaxima show a jump periodicity of 110.03 min, the cause of which has not been explained. (auth)

12318 LINEAR, NON-ADIABATIC ANALYSIS OF MODELS OF DWARF CEPHEID VARIABLE STARS. Percy, J. R. (Univ. of Toronto). Mon. Notic. Roy. Astron. Soc.; 170: No. 1, 155-163 (Jan 1975).

A linear nonadiabatic pulsation analysis of models of dwarf Cepheid variable stars has been carried out. The models include convection, radiation pressure, surface boundary condition determined from model atmospheres, and opacity determined either analytically or by quadratic interpolation in tables. The results have been compared with observations by using a temperature–color relation and a period–density relation, assuming that the masses of the stars are 0.5 solar mass. Best agreement between theory and observations occurs if the hydrogen content by weight is between 0.70 and 0.75. The problem of the evolutionary state of these stars is discussed briefly. (auth)

12319 RADIO AND INFRARED SPECTRUM OF EARLY-TYPE STARS UNDERGOING MASS LOSS. Wright, A. E.; Barlow, M. J. (Univ. of Sussex, Eng.). Mon. Notic. Roy. Astron. Soc.; 170: No. 1, 41-51(Jan 1975).

A unified model is presented for the radio and infrared spectrum of early-type stars surrounded by a gaseous ionized envelope resulting from mass loss. The cases of uniform mass loss (i) at

constant velocity, and (ii) with accelerative effects taken into account, are treated. It is shown that the radio and infrared free–free spectra are predicted to be of the form $S_\nu \propto \nu^{0.6}$ except (typically) in the near infrared where the spectrum will become flatter. Various effects which may cause a deviation from a 0.6 spectral index are considered. Finally, it is shown how radio and infrared flux densities may be used to derive mass loss rates and to obtain lower limits to the number of ionizing photons emitted per second by the underlying stars. (auth)

12320 SILICATE ABSORPTION AT 18^{1} m IN TWO PECULIAR INFRARED SOURCES. Simon, T.; Dyck, H. M. (Univ. of Hawaii, Honolulu). Nature (London); 253: No. 5487, 101-102(10 Jan 1975).

It is stated that two broad emission features often observed in the infrared spectra of cool stars near 10 and 18μm are usually attributed to thermal radiation by silicate dust grains. The detection of 18μm absorption features in the spectra the strong infrared source AFCRL 809-2992 and an infrared object associated with the microwave source OH 26.5 + 0.6 is here reported, using multifilter infrared photometry. Strong evidence was obtained to support suggestions that the absorbing agent is silicate dust. Models are discussed. (UK)

12321 DEGENERACY EFFECTS ON NEUTRINO MASS EJECTION IN SUPERNOVAE. Mazurek, T. J. (Harvard Coll. Observatory, Cambridge, MA). Nature (London); 252: No. 5481, 287-289(22 Nov 1974).

It is stated that although type II supernovae appear to occur predominantly in stars significantly more massive than the Sun, a precise stellar mass range for these events cannot be defined observationally. Theoretical interpretations of observational data, however, seem to indicate that the masses are significantly greater than $8M_\odot$. Observational evidence may also exist that stars with masses $<6M_\odot$ cease nuclear burning before a critical supernova configuration evolves, and if this is the case the total supernovae contribution from stars of lower mass is negligible. Attempts to explain supernovae in massive stars theoretically have been based on either nuclear fuel detonation or neutrino energy deposition in the infalling envelope during dynamic stellar collapse. The former, however, does not release sufficient energy to account for a type II explosion, and findings on the latter mechanism are contradictory and not very encouraging. In the present communication attention is directed to the neutrino transport mechanism. It is argued that the zero chemical potential condition imposed on the neutrinos in existing computations suppresses leptonic neutrino transport characteristics that may lead to supernova mass ejection. The results of the study indicate that the effects of lepton conservation may be significant in supernova neutrino transport. (UK)

12322 THE SYMBIOTIC STAR CI CYGNI FROM 1965 TO 1972. Gravina, R. (Observatoire de Lyon, 69- Saint-Genis-Laval (France)). Compt. Rend., Ser. A, B; 280: No. 5, 115-116(3 Feb 1975). (In French).

Variations in the spectrum of the symbiotic star CI Cygni from 1965 to 1972 are presented. From 1965 to June 1971 highly excited forbidden lines were observed, particularly Fe VII and He II (lambda) 4686 A. In June 1971 the star increased in brightness, and these lines disappeared. From December 1971 to February 1972 the late-type spectrum was absent, and a P Cygny type profile appeared for some lines. (auth)

12323 MOLECULAR PROBLEMS IN ASTROPHYSICS. Lequeux, J. (Observatoire de Paris, Section de Meudon, 92 (France)). pp 161-167 of Methods of Doppler Natural Linewidth Spectroscopy of Excited Levels in Simple Molecular Systems. Paris, France; Centre National de la Recherche Scientifique (1974).

From international colloquium on Doppler natural linewidth spectroscopy of excited levels in simple molecular systems; Aussois, France (23 May 1973).

The recent discovery of many interstellar molecules by radio-astronomy and far-ultraviolet spectroscopy raises many fundamental problems concerning the formation and destruction processes for these molecules, and the excitation of their energy levels. Excitation processes are described on a few examples, and it is shown that molecules are a powerful tool for studying the physical conditions in dense interstellar matter. (auth)

12324 THE OUTBURST OF THE HD200120 STAR. Duval, M.; Lacoarret, M.; Herman, R.; Hubert, H. (Observatoire de Haute Provence, 04- Saint-Michel-l'Observatoire (France); Observatoire de Paris, Section de Meudon, 92 (France). Section d'Astrophysique). Compt. Rend., Ser. A, B; 280: No. 7, 193-194(17 Feb 1975). (In French).

In December 1973, a hydrogen explosion was observed in the HD200120 star, through its hydrogen spectrum. This star belongs to a group of stars situated in the spiral arms of the galaxy, and its age is approximately $20 \cdot 10^6$ years. A table of this type of stars is presented. The time period of their activity seems to be 20 years (or more). (FR)

12325 NONEXPLOSIVE COLLAPSE OF THE WHITE DWARFS. Canal, R.; Schatzman, E. (Departamento de Fisica de la Tierra y del Cosmos, Universidad de Barcelona (Spain); Observatoire de Paris, Section de Meudon, 92 (France)). Compt. Rend., Ser. A, B; 279: No. 26, 681-682(23 Dec 1974). (In French).

A white dwarf, near to the relativistic critical mass and with a suitable chemical composition such as, carbon, is shown to be able to collapse without explosion, the endothermal neutronization preceding the exothermal pycnonuclear reactions. The model could explain the presence of a neutron star in close packed binaries, such as X sources. (FR)

12326 INTERSTELLAR IONIZED NEBULAE. Terzian, Y. (Cornell Univ., Ithaca, NY); Balick, B. Fundam. Cosmic Phys.; 1: No. 4, 301-386(Jul 1974).

The discussion of interstellar ionized nebula covers the physical structure, emission processes, prominent nebulae, the distribution of ionized nebulae in the galaxy, chemical abundances, and the evolution of HII regions. (JFP)

12327 AUTOCORRELATION ANALYSIS OF THE BRIGHTNESS OF Z AND AG DRA. Lenderman, E. I. (Astronomical Observatory, Kiev). Astrometriya Astrofiz.; No. 24, 71-74(1974). (In Russian).

The autocorrelation function of the brightness of Z And with $\tau_{max} = 800^d$ and two autocorrelation functions of the brightness of AG Dra for two parts of L. Robinson's observations with $\tau_{max} = 500^d$ were obtained. The functions indicate a period of 600^d for Z And and a period of 380^d for AG Dra. (3 figures) (auth)

12328 INVESTIGATION OF PULSATING VARIABLES. III. Cepheid Monochromatic Light Gradients. Kolesnik, I. G.; Krivdik, V. G. (Astronomical Observatory, Kiev). Astrometriya Astrofiz.; No. 24, 56-64(1974). (In Russian).

By using a series of monochromatic magnitudes for two classical cepheids — η Aql, δ Cep — and two variables of RR Lyrae type — RR Lyr, SU Dra — monochromatic light gradients $G_j^i = (\Delta m_{\lambda i} / \Delta m_{\lambda j})$ are calculated. The authors showed that monochromatic light gradients give information on the relative amplitudes of radial variations at different levels of atmosphere. On the basis of the data obtained the properties of wide-band gradient diagrams for cepheids (G_u, G_v) was discussed. It was concluded that the diagrams can be considered as a distribution of stars according to their pulsation parameters at different atmospheric depths. (auth)

12329 ENERGY DISTRIBUTION IN SPECTRA OF TEN STARS OF B2–G9 TYPE. Komarov, N. S.; Depenchuk, E. A.; Chuprina, R. I. (Odessa State Univ.). Astrometriya Astrofiz.; No. 24, 65-70(1974). (In Russian).

Stellar spectrograms were obtained at the Terskol astronomical station of the Main Astronomical Observatory of the Ukrainian Academy of Sciences by the Seya–Namioka spectrometer attached to the AZT-14 reflector. Following the technique adopted at the Odessa Astronomical Observatory, the energy distributions E_λ in ten stars of different spectral types (B2–G9) in the spectral region from 3250 to 7500 Å were calculated. Values of E are given in absolute units (erg/cm^2). The results of other author's data are compared. (auth) (2 figures, 2 tables)

12330 VARIABILITY OF THREE STARS IN THE VICINITY OF OPEN CLUSTER NGC 6830. Shaganyan, B. L.; Subbotina, L. M. (Kherson Pedagogical Inst., USSR). Astrometriya Astrofiz.; No. 24, 80-87(1974). (In Russian).

As part of an investigation of all the variable stars in the vicinity of the open cluster NGC 6830, results are given of photographic observations of OQ, PR, and NT Aql. The magnitudes were estimated on plates obtained at the Sternberg Astronomical Institute by using the Nijland–Blazhko method. Maps of surroundings, photographic magnitudes of comparison stars, and epochs of maximum brightness are given for each variable star. (auth) (7 figures, 4 tables)

12331 BEST LINEAR APPROXIMATION OF LIMB DARKENING LAWS FOR DWARF STARS WITH THIN PHOTOSPHERE. Rubashevskii, A. A. (Kiev Planetarium). Astrometriya Astrofiz.; No. 24, 88-90(1974). (In Russian).

Various linear approximations to nonlinear limb darkening laws for stars with thin photospheres are discussed. Discrete analogs of integral relations are given for determination of linear limb darkening laws. The linear approximation for which the full flux of stellar radiation is constant appears to be the best one. (auth)

12332 LIMITING DENSITY IN WHITE STARS. Sharma, J. P. (M. M. M. Engineering Coll., Gorakhpur, India). Indian J. Phys.; 48: No. 12, 1143-1145(Dec 1974).

The values of the electronic concentration per unit volume and the equilibrium mass are found for stars of the white dwarf type. (JFP)

12333 EVOLUTION OF STARS AND GALAXIES: CONDENSATION OR EXPANSION. Mirzoyan, L. (Erevan Observatory). Sov. Sci. Rev.; 3: No. 5, 300-308(Sep 1972).

The two hypotheses concerning the origin of stars and galaxies, the idea of a contraction or an expansion, contradict one another in essential points, and have divided astronomers into two camps. But the new discoveries of quasars and central bodies in many galaxies seem to be gradually refuting the contraction hypothesis. The question is whether "proto-stars" exist at the centers of galaxies. (auth)

Quasi-Stellar, Radio, and X-Ray Sources

Refer also to abstracts 12423, 12429, and 12443.

12334 PRIMARY OF CEN X-3. Wickramasinghe, D. T.; Vidal N. V.; Bessell, M. B. (Australian National Univ., Canberra). Mon. Notic. Roy. Astron. Soc.; 169: No. 3, 63P-67P(Dec 1974).

Recently published reports of Krzeninski's (IAUC; no. 2612: (1973)) optical counterpart for Cen X-3 are shown to be consistent with the hypothesis that the primary is in contact with its inner critical Roche lobe. An orbital inclination $i \sim 90°$ and a mass ratio $q \sim 0.045$ is indicated. The primary may be somewhat overluminous for its mass. The possibility of detecting 4.8 s optical pulsations is discussed. (auth)

12335 MEASURED OFF SET BETWEEN THE CRAB PULSAR AND TAU X-1. Davison, P. J. N. (Mullard Space Science Lab., Dorking, Eng.); Culhane, J. L.; Morrison, L. V. Nature (London); 253: No. 5493, 610-612(20 Feb 1975).

Some observations made on October 7th 1974 during measurements of the effective diameter of the Crab Nebula and the location of the centroid of the emission with regard to the accurately known pulsar position, using the MSSL x-ray detector on the Copernicus spacecraft, are described. On that date the satellite's orbit took it through the Tau X-1 lunar occultation "shadow" on two successive orbits, enabling observation of two disappearances and two reappearances of the Crab Nebula using a collimated proportional counter operating in the energy range 2.5 to 7.5 keV. Most of the x-ray flux was found to be asymmetrically disposed with respect to the pulsar, and the x-ray emitting region was significantly smaller than the optical nebula; there also seemed to be a lack of any dependence of the size of the x-ray emission region on photon energy. Models are discussed. In view of the significant displacement between the emission centroid and the pulsar, which is generally presumed to be the ultimate source of the electrons, a search should be made for some reasons why the electrons generate x-rays predominantly in the region to the west or north-west of the pulsar. (UK)

12336 ORIGIN OF THE OPTICAL EMISSION FROM SCO X-1. de Freitas Pacheco, J. A. (Univ., Sao Paulo, Brazil). Nature (London); 253: No. 5494, 699-701(27 Feb 1975).

It is stated that discordant results have been reported for variations in the light curve of Sco X-1; some workers have reported a periodic variation of 3.93d, with a mean amplitude of 0.8 mag, whilst others claim variations of 0.22 mag with a period of 0.787d. Although caution should be exercised in accepting these values speculation may be made concerning their nature. With the usual assumption that the visible light is emitted by a hot optically thick plasma, that is also responsible for the x-ray emission, it is difficult to understand the observations. A model is proposed that can explain some of the observations. A binary system is assumed, very similar to the Her X-1-HZ Her system, comprising a degenerate neutron star, which is the x-ray source, together with a nondegenerate star. Heating of the atmosphere of the nondegenerate star by the x rays will produce a hot spot, which is assumed to be responsible for most of the visible emission. It is also assumed that the x-ray emission is nearly isotropic. (UK)

12337 NEW OBSERVATIONS OF THE ANGULAR DIAMETER-REDSHIFT RELATION FOR RADIO SOURCES. Hewish, A.; Readhead, A. C. S.; Duffett-Smith, P. J. (Mullard Radio Astronomy Observatory, Cambridge, Eng.). Nature (London); 252: No. 5485, 657-659(20 Dec 1974).

Measurements of the angular sizes of radio source components in the range 0.1" to 1.0", using the technique of interplanetary scintillation, show an absence of small-diameter sources at the largest redshifts. The cosmological implications of this result are discussed. (auth)

12338 22.2-GHz HIGH EMISSION NEBULOSITIES ASSOCIATED WITH THE CARINA NEBULA CENTRAL REGION. Scalise, E.; Kaufmann, P.; Braz, M. A. (Univ. Mackenzie, Sao Paulo, Brazil). Nature (London); 252: No. 5485, 663-664(20 Dec 1974).

It is stated that maps of the Carina Nebula, obtained at relatively low frequencies, show that most of the radiation arises from a central region and has a simple double structure, separated by about 9.4'. Some observations are here reported using the 13.7m radiotelescope of the Itapetinga Radio Observatory, Brazil. A continuum map at 22.2 GHz was obtained for the central region, using a 4' beam width and a linearly polarised feed, and this map is reproduced. Two main sources, previously identified at 5 GHz, were evident, but the whole region appeared rather more complex at the higher frequency, and two new structures appeared. There was no good correspondence between the radio features at 22.2 GHz and the optical features. Of the two main sources one appears to be a normal H II region; the other appears to receive contributions from sources with high emissions. The two new sources may be very compact H II regions, with high mean emission. Measurements at other frequencies, however, are required to better understand the nature of this interesting nebula. (UK)

12339 MODEL FOR 1.24 S X-RAY PULSES IN Her X-1. Feigelson, E. D. (Haverford Coll., PA). Nature (London); 253: No. 5489, 250-251(24 Jan 1975).

It is stated that the 1.24 sec. x-ray pulses observed in the 2 to 20 keV region from Her x-1 are thought to arise from matter being accreted on to a rotating magnetic neutron star, and the pulsed emission is thought to be produced by a process analogous to that of radio pulsars. Proposed models are discussed and criticisms are advanced. The author proposes that the 1.24 sec. pulses originate from luminosity variations at the source, arising from time-varying accretion rather than from the passage of a beam of constant intensity past the Earth. (UK)

12340 NEW VARIABLE RADIO SOURCE IN CYGNUS. Adgie, R. L.; Palmer, H. P.; Penston, M. V. (Royal Radar Establishment, Malvern, Eng.). Mon. Notic. Roy. Astron. Soc.; 170: No. 2, 31P-34P(Feb 1975).

Observations made at NRAO, Greenbank, at a wavelength of 3.7 cm of a source in Cygnus revealed a flux variation from 2.2 to 6.3 Jy during 1973. Although the field was very crowded because of the low galactic latitude, accurate radio and optical position measurements have yielded a provisional identification with a blue stellar object which had a magnitude of 19.5 on the Sky Survey. The identification is confirmed by recent optical observations showing that the object had brightened to 18.5 by 1973 November. A spectroscopic examination has revealed an emission feature near 4300 Å, and the object is almost certainly a quasar. (auth)

12341 COPERNICUS: X-RAY OBSERVATIONS OF 3C 390.3. Charles, P. A.; Longair, M. S.; Sanford, P. W. (Mullard Space Science Lab., Dorking, Eng.). Mon. Notic. Roy. Astron. Soc.; 170: No. 2, 17P-22P(Feb 1975).

The MSSL x-ray telescopes on OAO-Copernicus have detected 2.5 to 7.5 keV x rays from the direction of the N galaxy 3C 390.3. Upper limits are placed on the flux in the 0.6 to 3.1 keV range from 3C 390.3 itself. The detected signal is at least a factor of four greater than that expected from the nearby x-ray source 3U 1825 + 81. (auth)

12342 DETECTION OF H_2O EMISSION FROM THE FAR-INFRARED SOURCE AFCRL (UOA) 19. White, G. J.; Little, L. T.; Parker, E. A.; Nicholson, P. S.; Macdonald, G. H.; Bale, F. (Kent Univ., Canterbury, Eng.). Mon. Notic. Roy. Astron. Soc.; 170: No. 2, 37P-38P(Feb 1975).

22.2 GHz radiation from interstellar water vapor has been detected in the far infrared source AFCRL (UOA) 19. The H_2O source does not appear to be dynamically associated with the CO, HCN, and CS clouds already detected in AFCRL (UOA) 19. (auth)

12343 OPTICAL PROPERTIES OF BINARY STAR SYSTEMS WITH ACCRETION DISCS. Lin, D. N. C. (Cambridge Univ., Eng.). Mon. Notic. Roy. Astron. Soc.; 170: No. 2, 379-392(Feb 1975).

This paper derives a correlation between the period and the optical visibility of a hot spot on an accretion disc in a close

binary system. X-ray binaries and rapid blue variables are considered. It is suggested that the emission line features and secondary pulses might be used to detect the existence of faint hot spots. In principle these observable features might be used to determine the mass ratio of the system and the relative size of the accretion disc. Possible sources of error, caused by uncertainties in the observation, are discussed. For the HZ Her–Her X-1 system, the mass ratio is estimated and an explanation is given for the observed marching of the dips in the x-ray light curve. (auth)

12344 FLUX-DENSITY VARIATIONS OF THE RADIO EMISSION FROM CYGNUS X-3. McEllin, M. (Cambridge Univ., Eng.). Mon. Notic. Roy. Astron. Soc.; 170: No. 1, 1P-6P(Jan 1975).

The Cambridge 5-km telescope has been used to monitor the flux density variations of the radio emission from Cygnus X-3 over the period 1972 September to 1974 August. The results have been combined with those of other groups to provide a fairly complete picture of the behavior of Cygnus X-3 at radio frequencies since the 1972 outburst. (auth)

12345 NATURE OF HER X-1. Wang, Y. M. (Massachusetts Inst. of Tech., Cambridge). Nature (London); 253: No. 5489, 249-250(24 Jan 1975).

Observations of hard x rays from Her x-1 have been reported that appear to set an upper limit of 10% on the pulsating component in the energy range 20 to 45 keV (Iyengar and others Nature 251 : 292(1974)). It is emphasized, however, that the absence or near absence of hard x-ray pulses has not been confirmed by other authors. The present authors offer a simple explanation of the observations that does not require the additional source of x rays postulated by Iyengar. (UK)

12346 SPECTROSCOPIC INVESTIGATION OF X PERSEI (=2U 0352 + 30.). Hutchings, J. B.; Crampton, D.; Redman, R. O. (Dominion Astrophysical Observatory, Victoria, B. C.). Mon. Notic. Roy. Astron. Soc.; 170: No. 2, 313-324(Feb 1975).

Radial velocity and line intensity measurements are reported from recent high dispersion spectrograms of X Persei. The binary interpretation of the previously reported 580-day periodicity is discussed and revised orbital parameters are presented. Line intensity changes occur but are not found to be correlated with this cycle. Rapid line profile changes have been observed with an Image Isocon camera. The emission line profiles are discussed in terms of binary model. (auth)

12347 ANALYSIS OF DATA FROM ROTATION MODULATION COLLIMATORS. Cruise, A. M. (Mullard Space Science Lab., Dorking, Eng.); Willmore, A. P. Mon. Notic. Roy. Astron. Soc.; 170: No. 1, 165-175(Jan 1975).

Three methods of analyzing data from rotation modulation collimators are discussed and only one is found to be at all satisfactory. A new algorithm has been developed which decreases the time required to perform this cross-correlation analysis considerably. Previous calculations of the image shapes resulting from the inclusion of weighting functions in the cross-correlation are corrected and the effect on image shape and intensity of rotation axis motion during an observation is described. Corrections to the image intensity have been derived for two special cases of spin axis motion and these are used to evaluate the results of two x-ray observations from sounding rockets. In both cases the intensity corrections are found to be in good agreement with the observations. (auth)

12348 HIGH-RESOLUTION RADIO OBSERVATIONS OF THE SOURCES NEAR K3-50. Harris, S. (Cambridge Univ., Eng.). Mon. Notic. Roy. Astron. Soc.; 170: No. 1, 139-153(Jan 1975).

The group of radio sources near the optical object K3-50 has been observed at 5 GHz with the Cambridge 5-km telescope. Two of the sources contain high-density compact structure, and the one coincident with K3-50 itself has an unusually high brightness temperature. The new radio data are compared with infrared and optical observations of these sources and the anomalous extinction is discussed in terms of a scattering model. (auth)

12349 INVESTIGATION OF THE OPTICAL FIELDS OF 35 3CR RADIO SOURCES TO FAINT LIMITING OPTICAL MAGNITUDES. Longair, M. S. (Cambridge Univ., Eng.); Gunn, J. E. Mon. Notic. Roy. Astron. Soc.; 170: No. 1, 121-138(Jan 1975).

The fields of 35 3CR radio sources, for which detailed radio structural information is available, have been investigated using the 200-in. Hale telescope to a uniform limiting apparent magnitude of about 23.5 or 24. Plates of 34 of these fields are presented. An analysis of the identification content of a complete sample of 46 3CR radio sources shows that the identifications are 78 per cent complete to this limiting magnitude. All the identifications fainter than apparent magnitude 20 are radio galaxies. Various problems which hamper the identification of radio sources are discussed in the light of these results. It is concluded that, while some of the nonidentifications may be due to gross asymmetries of the radio source structures, some of the unidentified sources must still lie beyond the present plate limits. (auth)

12350 HIGH FREQUENCY RADIO SPECTRA OF SECONDARY STANDARD SOURCES. Ross, H. N.; Seaquist, E. R. (Univ. of Toronto). Mon. Notic. Roy. Astron. Soc.; 170: No. 1, 115-119 (Jan 1975).

Eight sources commonly used as standards were compared at 3.24, 6.63, and 10.63 GHz with 3C 274, a source that has been established recently on an absolute scale. As a result, accurate high-frequency spectra for these eight sources have been obtained. (auth)

12351 FORCE-FREE PULSAR MAGNETOSPHERE. II. The Steady, Axisymmetric Theory for a Normal Plasma. Okamoto, I. (International Latitude Observatory, Mizusawa, Japan). Mon. Notic. Roy. Astron. Soc.; 170: No. 1, 81-93(Jan 1975).

A physically reasonable field structure in the force-free pulsar magnetosphere is discussed in the steady, axisymmetric theory for a normal plasma. The null line where the charge density ρ_e vanishes must cross the critical field line near the light cylinder $\tilde{\omega}_1$ from the equator side and approach to it again from the pole side as the axial distance $\tilde{\omega}$ increases to infinity in a plausible field model. One difficulty of the theory is, however, that there must be a mechanism which draws out charges of both sign from the neighborhood of the critical field line P_c, if all charges are assumed to emanate only from the pulsar surface. (auth)

12352 OPTICAL MONITORING OF RADIO SOURCES. IV. Results up to April 1973. Selmes, R. A.; Tritton, K. P.; Wordsworth, R. W. (Royal Greenwich Observatory, Hailsham). Mon. Notic. Roy. Astron. Soc.; 170: No. 1, 15-40(Jan 1975).

Results for a period ending in 1973 April are presented from the Herstmonceux programme of optical monitoring of radio sources and compact galaxies. Thirty-six quasars, galaxies, and BL Lac objects are listed. (auth)

12353 STRUCTURES AND PROPERTIES OF 4C RADIO SOURCES IN ABELL CLUSTERS. Riley, J. M. (Cambridge Univ., Eng.). Mon. Notic. Roy. Astron. Soc.; 170: No. 1, 53-79 (Jan 1975).

To investigate the nature of the radio sources and their associated galaxies in rich clusters of galaxies, observations have been made with the Cambridge One-Mile telescope at 408 and 1407 MHz of the 25 sources in the 4C catalogue in the declination range 20° to 40° which lie in Abell clusters. The results of the observations of 16 of these sources are presented here in tabular form and as contour maps; finding charts are also given for the hitherto unidentified sources. The results of the observations of the remaining nine sources in the sample have been presented elsewhere. Observations of five of the sources with the 5-km telescope at 5 GHz are also presented. The main conclusions which can be drawn from these observations and those of four of the remaining nine are discussed briefly. (auth)

12354 DETECTION OF THE 3_1-3_1(A) TRANSITION OF METHANOL IN SAGITTARIUS B2. Robinson, B. J. (CSIRO, Epping, Australia); Brooks, J. W.; Godfrey, P. D.; Brown, R. D. Aust. J. Phys.; 27: No. 6, 865-868(Dec 1974).

The 3_1-3_1 A-branch transition of methanol has been observed in emission in Sgr B2. A laboratory determination of the rest frequency of 5005·32 MHz indicates that the radial velocity of the line in Sgr B2 is 57 kms^{-1}. (auth)

12355 EXTRAGALACTIC DOUBLE RADIO SOURCES. Current Observational and Theoretical Position. Blandford, R. D.; Ress, M. J. (Cambridge Univ., Eng.). Contemp. Phys.; 16: No. 1, 1-16(Jan 1975).

Recent high-resolution observations of powerful double radio sources have revealed both compact high brightness regions and extended low brightness regions, as well as complex polarization structure. This is consistent with the view that the sources have their energetic origins in the compact nuclei of galaxies and quasars and that energy must be supplied continuously during the source's active lifetime. Possible models involving either the formation of two antiparallel beams of hot plasma or the ejection of massive objects are discussed. (auth)

Solar Phenomena

Refer also to abstracts 12459, 12464, and 12491.

12356 (BNL-tr-599) DIFFICULTIES IN INTERPRETING THE SOLAR NEUTRINO EXPERIMENT. Vasil'ev, S. S. Translated by S. J. Amoretty from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 2, 304-309(1975). 12p. Dep. NTIS $4.00.

The hypotheses previously proposed to explain the negative results obtained in experiments on the detection of solar neutrinos are critically analyzed. The hypotheses that either explicitly or implicitly assume that the sun is not a conventional main sequence star are mainly considered. (JFP)

12357 (INIS-mf-1562) CONVERSION OF MAGNETIC INTO ELECTRIC ENERGY IN A CAVITY INITIALLY BOUNDED BY ANTIPARALLEL MAGNETIC FIELD AS A MECHANISM OF SOLAR FLARES. Matsuura, O. T.; Gramaccini, F. J.; de Almeida, A. A. (Sao Paulo Univ. (Brazil). Instituto Astronomico e Geofisico). [nd]. 8p. INIS.

The formation, during the early phase of solar flares, of electromagnetic "cavities" in which a quasi-vacuum condition prevails, can explain the rapid conversion of the energy of antiparallel magnetic fields into capacitive energy. However only a small fraction of this energy is converted into the kinetic energy of solar cosmic rays. (auth)

12358 RARE GASES IN SEPARATED WHITLOCKITE FROM THE ST. SEVERIN CHONDRITE: XENON AND KRYPTON FROM FISSION OF EXTINCT ^{244}Pu. Lewis, R. S. (Univ. of California, Berkeley). Geochim. Cosmochim. Acta; 39: No. 4, 417-432 (Apr 1975).

Helium, neon, argon, krypton, and xenon data are presented from stepwise heating of samples of the mineral whitlockite from the chondritic meteorite St. Severin. The xenon is shown to be a uniform mixture derived from ^{244}Pu fission and rare-earth element spallation. The krypton similarly contains spallation products and ^{86}Kr from ^{244}Pu fission. Plutonium-244 fission yields of ^{80}Kr/^{129}Xe/^{131}Xe/^{132}Xe/^{134}Xe/^{136}Xe = 1.9 ± 0.5/4.8 ± 5.5/24.6 ± 2.0/88.5 ± 3.0/93.9 ± 0.8/ ≡ 100 are obtained. The helium, neon, and argon are dominated by spallation and radiogenic ^{4}He and ^{40}Ar. A pile neutron irradiation experiment does not yield a unique Pu/U ratio for this mineral but yields ratios varying from 0.045 down to 0.017. Both the high concentration of ^{244}Pu fission xenon and the high ratio of Pu/U previously reported by Wasserburg et al. (J. Geophys. Res.; 74:4221 (1969)) are thus confirmed. (auth)

12359 COLLISIONAL HEATING OF INTERPLANETARY GAS: FOKKER-PLANCK TREATMENT. Wallis, M. K. (Oxford Univ.). Planet. Space Sci.; 23: No. 3, 419-430(Mar 1975).

Interstellar gas streaming through the solar system undergoes both elastic collisions with solar-wind ions and destructive, ionizing processes. The Boltzmann equation is set up, with linear Fokker-Planck terms describing the glancing elastic collisions. Solutions combining the dynamical effects of the central force field and the diffusion in velocity space are derived, appropriate to cool gas. For the He component of the streaming gas, if initially at 100 K, the collisional heating dominates inside 2 AU upstream and 5 AU downstream. A modified formula is given for the density in the downstream wake, as enhanced by gravitational focussing. Calculations of the helium resonant radiation backscatter require substantial modification. (auth)

12360 ELEMENTAL ABUNDANCES IN INTERPLANETARY DUST. Brownlee, D. E.; Tomandl, D. A.; Hodge, P. W.; Horz, F. (Univ. of Washington, Seattle). Nature (London); 252: No. 5485, 667-669(20 Dec 1974).

It is generally believed that most of the interplanetary dust is generated by the gradual disintegration of comets in the inner solar system, and analysis of the dust grains is thus a technique for obtaining information on the nature of cometary matter. So far, however, no particles having an unquestionable interplanetary origin have been subjected to detailed chemical analysis. Measurement of elemental abundances is here reported for two interplanetary dust grains from meteoroidal residue found inside micrometeoritic craters in the Al surface of the transuranic cosmic-ray experiment which was exposed to space for 67 days during the Skylab IV mission. X-ray analysis revealed the presence of Fe, Mg, Si, Ca, and Ni. Electron microprobe analysis was also applied, and showed Fe and S as major elements, and Ni and Mg as trace elements. The Fe:S ratio was consistent with FeS, and the Fe, S, and Ni residues indicated that the craters may have been produced by a troilite (or pyrrhotite) meteoroid. The Fe:Mg ratio was 50:1, so that the Mg content is not of major concern. Results of the analyses are shown graphically, and are compatible with chondritic abundances. Other evidence supporting similarities between chondritic meteorites and interplanetary material is mentioned. The apparent similarity between interplanetary material and carbonaceous chondrites should not, however, be regarded as evidence that both have a common source. (UK)

12361 BEGINNING OF A NEW CYCLE OF SOLAR ACTIVITY. Waldmeier, M. (Observatoire Federal, Zurich). Nature (London); 253: No. 5491, 419(6 Feb 1975).

It is stated that on November 15, 1974 a high latitude sunspot marked the beginning of a new cycle of solar activity. The present cycle is approaching its minimum, and a new cycle is thus starting before the old one has completely disappeared. The latitude of the sunspot was +37° and it was 60° for the central meridian. (UK)

12362 SUNSPOT CYCLE PERIODICITIES. Bagby, J. P. (Bell and Howell Co., Chicago). Nature (London); 253: No. 5491, 482(6 Feb 1975).

It is stated that the maximum entropy spectral analysis technique (Cohen and Lintz Nature 250: 398(1974)) has led to the discovery of periodicities in sunspot data and ability to predict ionospheric reflectivity and climatic features, but the theory that planetary influences can affect sunspot variations cannot be ruled out, as shown by further analysis of Cohen and Lintz's data. A different way of describing the cause of the 89.6 year peak in the data is suggested; this value is that obtained when oppositions and conjunctions of Uranus and Neptune are considered as a possible cause, and the author considers this to be the cause. The other periodic terms found by Cohen and Lintz can also be explained by the resonance of planetary mean motions. (UK)

12363 SOLAR NEUTRINOS AND SOLAR ROTATION. Roxburgh, I. W. (Queen Mary Coll., London). Mon. Notic. Roy. Astron. Soc.; 170: No. 2, 35P-36P(Feb 1975).

Recent criticisms by Monaghan (Mon. Not. R. Astr. Soc.; 169: 13P (1974)) of suggestions that rapid rotation lowers the neutrino flux from the Sun are replied to and shown to be invalid. Rapid differential rotation is capable of lowering the neutrino flux provided the ratio of centrifugal force to gravity decreases outwards in the Sun. (auth)

12364 INTENSITIES OF HELIUM LINES IN THE SOLAR EUV SPECTRUM. Jordan, C. (Harvard Coll. Observatory, Cambridge, MA). Mon. Notic. Roy. Astron. Soc.; 170: No. 2, 429-440(Feb 1975).

The present paper points out that the lines of neutral and singly ionized helium in the solar euv spectrum have anomalously high intensities when compared with lines of other ions formed at similar temperatures. It is suggested that the observed absolute and relative intensities, and in addition line widths, can be accounted for if a mechanism which causes the helium atoms and ions to be excited by electrons with temperatures greater than the ionization equilibrium value is operating. Further, the observed decrease of helium line intensities in coronal holes, whilst other transition region lines decrease little if at all, can be accounted for either by the reduction of the enhancement mechanism in coronal holes and/or by the reduced temperature gradient in these regions. An essential factor that makes the helium lines so sensitive to the presence of such a mechanism is the large value of the ratio of the excitation potential of the lines to the electron temperature. (auth)

12365 THE THIRD SOLAR WIND CONFERENCE: A SUMMARY. Russell, C. T. (California Univ., Los Angeles (USA). Inst. of Geophysics and Planetary Physics). Space Sci. Rev.; 17: No. 2-4, 435-447(Mar 1975).

From international solar-terrestrial physics symposium; Sao Paulo, Brazil (17 Jun 1974).

The Third Solar Wind Conference was convened from March 25 to 29, 1974 at the Asilomar Conference Grounds, Pacific Grove, California. The conference consisted of nine sessions dealing with solar abundances; the history and evolution of the solar wind; the structure and dynamics of the solar wind; the structure and dynamics of the solar corona; macroscopic and microscopic properties of the solar wind; cosmic rays as a probe of the solar wind; spatial gradients; stellar winds; and interactions with objects in the solar wind. This paper summarizes the invited and contributed talks presented at the conference. (auth)

12366 CHROMOSPHERIC FLARES OR CHROMOSPHERIC AURORAE. de Feiter, L. D. (Space Research Laboratory of the Astronomical Institute, Utrecht, The Netherlands). Space Sci. Rev.; 17: No. 2-4, 181-193(Mar 1975).

From international solar-terrestrial physics symposium; Sao Paulo, Brazil (17 Jun 1974).

This paper discusses some of the well-documented flare phenomena and possible analogies with magnetospheric substorm phenomena. Such analogies do exist, but also important differences. The combination of forces from magnetospheric and solar physicists will bring us closer to the understanding of these nearby examples of unstable cosmic plasmas. (auth)

12367 ENERGY BUILD-UP AND RELEASE MECHANISMS IN SOLAR AND AURORAL FLARES. Obayashi, T. (Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science). Space Sci. Rev.; 17: No. 2–4, 195-203(Mar 1975).

From international solar-terrestrial physics symposium; Sao Paulo, Brazil (17 Jun 1974).

Flare phenomena in the solar atmosphere and in the terrestrial magnetosphere exhibit many similarities. The mechanical energy of enhanced photospheric motion is converted and stored in the form of magnetic potential energy in sunspot fields, which is analogous to the case of the growth phase of magnetospheric substorms. The energy release during the explosive phase is initiated by a sudden collapse in the magnetic field topology and the X-type magnetic neutral point is created in the corona. Subsequent electrical discharge takes place in the form of an intense electrojet current flowing in the base of the chromosphere at the altitude where the Cowling conductivity is a maximum. It is suggested that the acceleration of particles by field-aligned electric fields and the Ohmic heating in the chromosphere result in major features of solar flares. (auth)

12368 AURORAL FLARES AND SOLAR FLARES. Nagata, T. (National Institute of Polar Research, Japan). Space Sci. Rev.; 17: No. 2–4, 205-220(Mar 1975).

From international solar-terrestrial physics symposium; Sao Paulo, Brazil (17 Jun 1974).

The morphology of development of auroral flares (magnetospheric substorms) for both electron and proton auroras is summarized, based on ground-based as well as rocket-borne and satellite-borne data with specific reference to the morphology of solar flares. The growth phase of an auroral flare is produced by the inflow of the solar wind energy into the magnetosphere by the reconnection mechanism between the solar wind field and the geomagnetic field, thus the neutral and plasma sheets in the magnetotail attaining their minimum thickness with a great stretch of the geomagnetic fluxes into the tail. The onset of the expansion phase of an auroral flare is represented by the break-up of electron and photon auroras, which is associated with strong auroral electrojets, a sudden increase in CNA, vlf hiss emissions and characteristic ulf emissions. The auroral break-up is triggered by the relaxation of stretched magnetic fluxes caused by cutting off of the tail fluxes at successively formed X-type neutral lines in the magnetotail. The resultant field-aligned currents flowing between the tailward magnetosphere and the polar ionosphere produce the field-aligned anomalous resistivity owing to the electrostatic ion-cyclotron waves; the electrical potential drop thus increased further accelerates precipitating charged particles with a result of the intensification of both the field-aligned currents and the auroral electrojet. It seems that the rapid building-up of this positive feedback system for precipitating charged particles is responsible for the break-up of an auroral flare. (auth)

12369 LARGE-SCALE AND SOLAR-CYCLE VARIATIONS OF THE SOLAR WIND. Neugebauer, M. (Jet Propulsion Lab., Pasadena, Calif. (USA)). Space Sci. Rev.; 17: No. 2–4, 221-254 (Mar 1975).

From international solar-terrestrial physics symposium; Sao Paulo, Brazil (17 Jun 1974).

This paper summarizes space probe observations relevant to the determination of the large-scale, three-dimensional structure of the solar wind and its solar cycle variations. Observations between 0.6 and 5 AU reveal very little change in the average solar-wind velocity, but a pronounced decrease in the spread of velocities about the average. The velocity changes may be accompanied by a transfer of energy from the electrons to the protons. The mass flux falls off approximately as the inverse square of distance as expected for spherically symmetric flow. Measurements of the interplanetary magnetic field show that the spiral angle is well defined over this entire range of distances, but there is some evidence that the spiral may wind up more slowly with distance from the Sun than predicted by Parker's model. The variance or noise in the field and plasma have also been measured as a function of radial distance. During the rising portion of the solar-activity cycle, the solar-wind velocity showed a pronounced positive correlation with solar latitude over the range ±7°. Several other plasma parameters which have been found generally to correlate (or anticorrelate) with velocity also showed a latitude variation; these parameters include the density, percent helium, and azimuthal flow direction. The average polarity and the north-south component of the magnetic field depend on the solar hemisphere in which the measurements are made. Dependence on the phase of the solar-activity cycle can be found in the data on the number of high speed streams, the proton density, the percent helium, and the magnetic-field strength and polarity. (auth)

12370 MICROSTRUCTURE OF THE SOLAR WIND. Voelk, H. J. (Chicago Univ., Ill. (USA). Enrico Fermi Inst.). Space Sci. Rev.; 17: No. 2–4, 255-276(Mar 1975).

From international solar-terrestrial physics symposium; Sao Paulo, Brazil (17 Jun 1974). 92 refs.

In this review microstructure is understood to summarize the dynamical properties of the solar wind that enter the fluid equations, usually employed to describe the overall flow, only in one or the other averaged form. Thus, first a description of the kinetic picture of the solar wind is given; it mainly involves the structure of the particle distributions in velocity space and associated instabilities. Waves and discontinuities are discussed next. Two selected examples are mentioned where the effects of waves and discontinuities play a role. Specific physical properties of the interplanetary magnetic irregularity spectrum and its relevance for cosmic-ray propagation are discussed at the end. (auth)

12371 INTERPLANETARY SHOCK WAVES: RECENT DEVELOPMENTS. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, Colo. (USA). Environmental Research Labs.). Space Sci. Rev.; 17: No. 2–4, 277-325(Mar 1975).

From international solar-terrestrial physics symposium; Sao Paulo, Brazil (17 Jun 1974). 77 refs.

Direct and indirect observations of interplanetary shock waves have been extended to the study of (i) the shock structure itself; (ii) the disturbed solar wind in its wake; (iii) additional discontinuities such as reverse shocks and pistons; and (iv) the shock's kinematic behavior. The last item - the trajectory - has benefited by the procedure (suggested by Pinter) of matching type II radio drift-inferred velocities with indirectly-inferred initial velocities found from at least two successive measurements in space. The significance of making type II observations at hectometric and kilometric wavelengths (as made, for example, by Slysh and Malitson, Feinberg and Stone) cannot be overemphasized due to this technique's ability to make unambiguous solar terrestrial relationships. More direct and physically-meaningful observations, however, are still dependent upon in situ plasma and magnetic field measurements. Additional emphasis is presently being placed on numerical modeling of shock-induced disturbances in the solar wind as generated by both flares and stream-stream interactions. The former mechanism is emphasized in this review with several recommendations for further research: (a) further numerical modeling for shocks, starting when they are "born" within relatively low-Alfven speed coronal regions; (b) expanded synoptic studies by spacecraft at various heliocentric longitudes, radii, and (eventually) latitudes with coordinated diagnostics; and (c) extended patrol of natural probes, such as comets, augmented with theoretical studies of possible shock-induced mechanical and chemical effects. (auth)

12372 INTERPLANETARY STREAMS AND THEIR INTERACTION WITH THE EARTH. Burlaga, L. F. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center). Space Sci. Rev.; 17: No. 2–4, 327-352 (Mar 1975).

From international solar-terrestrial physics symposium; Sao Paulo, Brazil (17 Jun 1974).

Plasma and magnetic field observations of interplanetary streams near 1 AU are summarized. Two types of streams have been identified - corotating streams and flare-associated, and other flow patterns are present due to interactions among streams. The theory of corotating streams, which attributes them to a high temperature region near the Sun, satisfactorily explains many of the effects observed at 1 AU. A correspondingly complete theory of flare-associated streams does not exist. Streams are a key link in the chain that connects solar and geomagnetic activity. The factors that most influence geomagnetic activity are probably related to streams and determined by the dynamics of streams. The evolution of streams on scales of 27 days and 11 years probably determines the corresponding variations of geomagnetic activity. (auth)

12373 INTERPLANETARY FIELD EFFECT ON THE MAGNETOSPHERE. Nishida, A. (Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science). Space Sci. Rev.; 17: No. 2–4, 353-389(Mar 1975).

From international solar-terrestrial physics symposium; Sao Paulo, Brazil (17 Jun 1974). 111 refs.

This paper reviews recent developments in the understanding of the solar wind magnetosphere interaction process in which the interplanetary magnetic field has been found to play a key role. Extensive correlative studies between the interplanetary magnetic field and the magnetospheric parameters have in the past few years yielded detailed information on the nature of the interaction process and have made it possible to follow the sequence of events that are produced inside the magnetosphere in

consequence of the solar-wind energy transfer. The observed effects of the interplanetary magnetic field, its north-south and east-west components in particular, found in various domains of the magnetosphere—dayside magnetopause, polar cap, magnetotail, auroral zone—are summarized, and an overall picture of the solar wind–magnetosphere interaction process presented. Dungey's reconnected magnetosphere model is used as a frame of reference and the basic compatibility of the observations with this model is emphasized. In order to avoid overlap with other review articles in the series discussion on the energy conversion process inside the magnetosphere leading to the substorm phenomenon is kept to the minimal. (auth)

12374 CLASSIFICATION OF SPECTRA OF K, Ca, Sc, Ti, V, AND Cr AND EXTRAPOLATION TO Fe SOLAR FLARE LINES. Fawcett, B. C.; Hayes, R. W. (Science Research Council, Abingdon, Eng.). Mon. Notic. Roy. Astron. Soc.; 170: No. 1, 185-197 (Jan 1975).

Potassium, calcium, scandium, titanium, vanadium, and chromium emission lines are classified in the same isoelectronic sequences as Fe XIX to Fe XXIII. Most of the lines identified belong to the $2p^n - 2p^{n-1}3d$ or $2s^22p^k - 2s2p^{k+1}$ transition arrays. The data presented permit the calculation of the wavelengths of Fe XIX to Fe XXIII emission lines which are emitted from solar flares. Experimental data are based on spectral observations of plasmas generated when the output of a 4 GW laser is focused on to solid targets. (auth)

12375 CO_2 AND HCN IN SUNSPOTS. Pande, M. C.; Guar, V. P. (Uttar Pradesh State Observatory, Naini Tal, India). Nature (London); 253: No. 5487, 104(10 Jan 1975).

It is stated that dissociation equilibrium calculations using three recent sunspot models indicate that CO_2 and HCN are fairly abundant in sunspots. Equivalent widths of selected lines of these molecules were calculated to ascertain if they might show up in the infrared region of the sunspot spectrum. Amongst other things it is concluded that the HCN fundamental bands may not show up in the infrared region of the sunspot spectrum. (UK)

12376 NEW MICROSTRUCTURE OF DECAMETRE SOLAR BURSTS. Sawant, H. S.; Alurkar, S. K.; Bhonsle, R. V. (Physical Research Lab., Ahmedabad, India). Nature (London); 253: No. 5490, 329-330(31 Jan 1975).

A new type of solar decameter radio burst is reported, observed in high-resolution spectral studies made over a frequency range of 0.5 MHz near 35 MHz. A circularly polarized crossed Yugi antenna was used for the observations, made in July to September, 1974. The bursts showed several components. Thirty-four of these bursts were recorded in the foregoing time interval. The bursts are referred to as "complementary bursts". Two different groups of delays between the components were observed, and the duration of all the bursts, at a given frequency, was $\lesssim 1$ sec. The delays were centered around 1 to 2 and 10 to 15 sec. Attempts are made to explain the bursts. (UK)

12377 RESPONSE OF A BOUNDED ATMOSPHERE TO A NON-RESONANT EXCITATION. I. Isothermal Case. Provost, J. (Observatoire de Nice, 06 (France)). Sol. Phys.; 40: No. 2, 257-273(Feb 1975).

The response of a bounded atmosphere to a non-resonant excitation applied at its basis is studied. It is shown that the essential feature related to this kind of excitation is that the distribution of the energy of the velocity field relatively to the frequency and horizontal wavelength is a function of height and merely depends on the structure of the atmosphere above the level at which it is considered. The preliminary results concerning an isothermal atmosphere are presented and their relevance to the solar case is discussed. (auth)

12378 THE NATURE OF THE SUNSPOT PHENOMENON. III. Energy Consumption and Energy Transport. Parker, E. N. (Chicago Univ., Ill. (USA). Dept. of Physics). Sol. Phys.; 40: No. 2, 275-289(Feb 1975).

This paper points out the basic relation between the conversion of thermal energy into convective fluid motion (Alfven waves when a strong vertical magnetic field is present) and the convective transport of thermal energy. It is shown that heat transport neccessarily accompanies convective driving of fluid motion. Convective motions restricted to a layer whose thickness is a small fraction of the local scale height can divert no more than the same fraction of the energy into Alfven waves. But if the convecting layer extends over many scale heights, then the convective forces may convert more energy into fluid motion than they transport. Hence the creation of a cool sunspot requires convection extending coherently over several scale heights, at least 500 km. This requirement is basically just the familiar thermodynamic efficiency of an ideal heat engine. The calculations establish that convection need not be much less efficient than the ideal. (auth)

12379 THE NATURE OF THE SUNSPOT PHENOMENON. IV. The Intrinsic Instability of the Magnetic Configuration. Parker, E. N. (Chicago Univ., Ill. (USA). Dept. of Physics). Sol. Phys.; 40: No. 2, 291-301(Feb 1975).

It is pointed out that the equilibrium configuration of a sunspot magnetic field, confined to the cool umbra by the pressure of the surrounding photospheric gas, is unstable to the familiar hydromagnetic exchange instability. The characteristic time for dissolution of the sunspot is of the order of one hour. In view of the observed long life of individual sunspots, it is important to understand why the instability does not develop. Several theoretical possibilities are reviewed, and it is suggested, tentatively, that the spot might be stabilized by a suitable redistribution of the cooling in the umbra. In particular, if the cooling extends to greater depth in an elongated portion of the sunspot, the magnetic pressure on the boundary is reduced there, tending to reduce the elongation. It is important to decide whether there is in fact any truth to this idea, because there are many features of sunspot behavior that are still not understood. (auth)

12380 ON THE BROADENING AND SHIFT OF SPECTRAL LINES. van Rensbergen, W.; de Doncker, E.; Deridder, G. (Brussels Univ. (Belgium). Inst. d'Astronomie et d'Astrophysique). Sol. Phys.; 40: No. 2, 303-315(Feb 1975).

The Van der Waals interaction between a radiator and a light neutral perturber explains the broadening and shift of spectral lines only partly satisfactorily. Comparison with solar observations suggests that these theoretical damping constants are systematically too low. Moreover, the theoretically predicted shifts of the lines agree only incidentally with those obtained in laboratory experiments. A combination of a Smirnov–Roueff (S–R) interaction potential and a Van der Waals (VdW) potential was used. The damping constants, thus obtained, are always somewhat higher than those obtained by a VdW potential alone. The agreement between theory and experiment for the shift of the line is —although not completely satisfactory — better than the very poor agreement resulting from a VdW potential. However, the S–R potential may not be used in the case that heavy perturbers are involved. In that case the VdW potential yields the better results. Fairly good agreement is found between theoretically and empirically determined values of γ for the solar centre. (auth)

12381 THE HYDROGEN BALMER LINES AND THE STRUCTURE OF THE QUIET SOLAR CHROMOSPHERE. I. Observations at the Limb. Mein, P.; Mein, N. (Sacramento Peak Observatory, AFCRL, Sunspot, New Mexico, USA). Sol. Phys.; 40: No. 2, 317-328(Feb 1975).

Spectra of Hα, Hβ, and Hδ have been taken under good seeing conditions with the vacuum tower telescope of Sacramento Peak Observatory. Intensity curves are given at various wavelengths in these lines to permit further comparison with a theoretical model. Moreover, considering in each case the range of height in which the lines are almost optically thin and using a few approximations, the following results are derived: between 2000 and 6000 km above the limb the average thermal + turbulent velocity of the atoms is found to increase from 20 km s^{-1} to 30 km s^{-1} and the mean number of hydrogen atoms per cm^3 in level 2 is given by $\log \eta_2 = 4.5 - 0.00056\ (z - 2000)$ z being the altitude above the limb in km. For line profile computations a new interpolation formula is presented; it gives good profiles with a small number of scans, saving microphotometer time. (auth)

12382 FAR-INFRARED SOLAR BRIGHTNESS MEASURED WITH A BALLOON-BORNE LAMELLAR-GRATING INTERFEROMETER. Stettler, P.; Rast, J.; Kneubuehl, F. K. (Eidgenoessische Technische Hochschule, Zurich (Switzerland)); Mueller, E. A. (Geneva Observatory, CH-1290 Sauverny, Switzerland). Sol. Phys.; 40: No. 2, 337-349(Feb 1975).

The solar brightness temperature was measured at wavelengths between 208 μ and 660 μ with a lamellar-grating interferometer. In order to avoid terrestrial absorption due to water vapor the measurement of the absolute spectral brightness was performed at altitudes of 30 km and 35 km with a balloon borne gondola. A cylindrical black body radiation source served as absolute calibration standard. Its wall temperature lay between 1100 K and 1300 K. Since the box of the interferometer and the black body could not be evacuated for the calibration, the air in the system was replaced by dry nitrogen. Nevertheless, residual water vapor absorption lines hampered the precision of the absolute calibration. The corresponding error could not be reduced to less than ±100 K. The present experimental temperature profile is compared to results obtained from other measurements. The

results agree with the empirical HSRA model and with those of other research groups in the spectral range between 208 μ and 660 μ. (auth)

12383 THE CORONAL HOLE AT THE 7 MARCH 1970 SOLAR ECLIPSE. Waldmeier, M. (Observatoire Federal, Zurich (Switzerland)). Sol. Phys.; 40: No. 2, 351-358(Feb 1975).

In 1957, the author described the morphology of the monochromatic corona, using synoptic charts of the green line intensity. Attention was drawn to regions of very low emission that could be identified on several consecutive rotations. For these features, the term "Löcher" that means "holes" was coined. Such a hole appeared in the SW-quadrant of the Sun at the total eclipse of March 7, 1970. From the photometry in white light, the density distribution in the hole has been calculated under the assumption of a circular cross section. In the central part, whose diameter is roughly half that of the whole hole, the density is less than 10% of the density of the undisturbed corona at the same distance from the Sun. The hole did appear in a region free of solar activity for three consecutive rotations. (auth)

12384 3.3 MILLIMETER LIMB BRIGHTENING MEASUREMENTS DURING THE 30 JUNE 1973 TOTAL SOLAR ECLIPSE. Shimabukuro, F. I.; Wilson, W. J.; Mori, T. T. (Aerospace Corp., El Segundo, Calif. (USA). Electronics Research Lab.); Smith, P. L. (Aerospace Corp., El Segundo, Calif. (USA)). Sol. Phys.; 40: No. 2, 359-370(Feb 1975).

Solar limb brightening measurements at a wavelength of 3.3 mm were made during the 30 June 1973 total solar eclipse from a site at Lake Rudolf, Kenya. The results show that at this wavelength there is a limb brightening of about 20%, occurring within one half arc min of the limb. (auth)

12385 STUDY OF THE PARTIAL SOLAR ECLIPSE OF 25 FEBRUARY, 1971 AT PIC DU MIDI. Rozelot, J. P.; Ratier, G. (Observatoire du Pic du Midi, 65 – Bagneres-de-Bigorre (France)). Sol. Phys.; 40: No. 2, 371-385(Feb 1975). (In French).

The scattering in the neighborhood of the Sun is investigated on photographs taken in Pic-du-Midi Observatory during the partial solar eclipse of February 25, 1971. Briefly mentioned, the diffraction theory is used to determine the image of a crescent with incoherent illumination, and to compare the "diffracted" isophote curves with those drawn from the plates. An accurate photometry of the plates enables us to give charts of the electronic density in a coronal sector, and also to determine some physical quantities, values of which are rather uneasy to get from usual observations, such as the polarization ratio and the electron density of the first Fe XIV excited level. In this last case, an original calculation was used to find the source function. A superimposition of a coronal enhancement in white light with a monochromatic arch, gives coherent results without any major assumptions. These assumptions are explained step by step and some interpretations are compared with those given by other authors. (auth)

12386 OBSERVED CORONAL TEMPERATURES AT 1,37 SOLAR RADII IN THE REGION OF A HELMET STRUCTURE. Liebenberg, D. H. (Los Alamos Scientific Lab., N. Mex. (USA)); Bessey, R. J.; Watson, B. (Wyoming Univ., Laramie (USA)). Sol. Phys.; 40: No. 2, 387-396(Feb 1975).

During the total solar eclipse, 1965 May 30, a 25 cm aperture f/8.0 telescope and Fabry–Perot interferometer were operated aboard the USAF–AEC aircraft. High resolution spectra of the Fe XIV emission line, 530.3 nm, were obtained. Deconvolved intensity vs wavelength profiles of the second order fringe overlay a helmet structure on the NM limb at out to 1.37 $R_\odot$. The profiles yield coronal temperatures, absolute intensities, and Doppler velocities in regions of apparently open magnetic field structure and within the closed field lines of the helmet. Together with white light intensities the observations are interpreted to provide temperatures and turbulent velocities in and around this coronal structure. Comparison is made with a model by Billings and Roberts. A model with radial flow (solar wind) velocities of ~60 km s^{-1} which satisfies the observations in the open field line region is suggested. (auth)

12387 INVESTIGATION OF FIVE WHITE LIGHT FLARES. Slonim, Yu. M.; Korobova, Z. B. (Astronomical Institute of the Uzbek Academy of Sciences, Tashkent, Astronomicheskaya, 33, USSR). Sol. Phys.; 40: No. 2, 397-410(Feb 1975).

On the basis of original observations, five white-light flares (WLF) are investigated. Evidence is given that their emission is located in two points brightening on either side of the line $H_{||} = 0$ and lying at the foot points of chromospheric loops. The area of WLF is ~5×10^{-6} hemisphere, i.e., ~0.007 of Hα flare area; the intensity of WLF is sometimes twice that of the background at the center of the disk. WLF are resolved into more bright and fine knots of ~2″ in diameter. The position of WLF coincides with the brightest knots of Hα flares which are characterized by wide wings with rapid increase and decrease. According to the estimates, the full output of the energy of a flare in the continuum and Hα are comparable; but, the energy emitted in integral light in time-unit through area-unit is by 2 orders of magnitude larger than the energy in monochromatic light (auth)

12388 SOME STUDIES ON SOLAR MICROWAVE BURSTS IN RELATION TO THE PHASES OF THE ASSOCIATED Hα–FLARES AND THEIR SPECTRAL NATURE. Sarkar, S. K.; Chattopadhyay, T. (University Coll. of Science, Calcutta (India)); Das Gupta, M. K. (Calcutta Univ. (India). Centre of Advanced Study in Radiophysics and Electronics). Sol. Phys.; 40: No. 2, 411-415(Feb 1975).

Occurrences of the flare-associated microwave bursts as well as their peak flux and energy excess spectra have been examined in relation to the pre- and post-maximum phases of the respective flares during the period 1969-72. Results obtained are: (i) about 76% of the flare-associated bursts occur in the pre-maximum phase and the remaining 24% occurs in the post-maximum phase irrespective of the flare classification, intensity-wise or area-wise; (ii) "impulsive" and "gradual rise and fall" bursts are relatively more important in the pre-maximum phase while "post burst increase" bursts show comparatively higher occurrences in the post-maximum phase; (iii) peak flux and energy excess spectra of the concurrent microwave bursts in the pre-maximum phase of the flare are mostly of "inverted U" and "increasing with frequency" spectral types. Of these "impulsive" bursts are predominantly of the "inverted U" and the "grF" bursts are of the "increasing with frequency" spectral type. (auth)

12389 TYPE IIIb RADIO BURSTS: 80 MHz SOURCE POSITION AND THEORETICAL MODEL. Takakura, T.; Yousef, S. (Commonwealth Scientific and Industrial Research Organization, Epping (Australia). Div. of Radiophysics). Sol. Phys.; 40: No. 2, 421-438(Feb 1975).

Culgoora spectrograph and radioheliograph observations are presented as well as a model of Type IIIb bursts; the latter are defined as chains of striae of slow or no frequency drift, the chain as a whole drifting like a normal Type III burst. The 80 MHz source positions are studied for a group of IIIb bursts, a IIIb precursor and harmonic pairs of 1:2 frequency ratio. It is found that the IIIb position may vary in a IIIb group. No significant difference was found between the source positions of a IIIb precursor and the following III burst. For one event it was found that the fundamental IIIb burst showed a high degree of circular polarization (~46%), while its second harmonic, a normal Type III burst, was unpolarized. It is suggested that the main cause for the striae in Type IIIb bursts is the existence of filamentary, density irregularities along the path of the electron stream. The denser filaments initially reduce the value of the density gradient along the electrons' path and thereby enhance their emissions over a small range of plasma frequencies. If the radio emission from the filaments dominates the emission from the ambient rarified plasma, striae appear in the spectrum and a Type IIIb burst results. This condition is more easily satisfied at the fundamental frequency and for electron streams of relatively high density. (auth)

12390 DIRECT OBSERVATIONS OF A FLARE RELATED CORONAL AND SOLAR WIND DISTURBANCE. Gosling, J. T.; Hildner, E.; MacQueen, R. M.; Munro, R. H.; Poland, A. I.; Ross, C. L. (High Altitude Observatory, Boulder, Colo. (USA)). Sol. Phys.; 40: No. 2, 439-448(Feb 1975).

Numerous mass ejections from the Sun have been detected with orbiting coronagraphs. Here for the first time the direct association of a coronagraph observed mass ejection, which followed a 2B flare, with a large interplanetary shock wave disturbance observed at 1 AU is documented and discussed. Estimates of the mass (2.4×10^{16}g) and energy content (1.1×10^{32} erg) of the coronal disturbance are in reasonably good agreement with estimates of the mass and energy content of the solar wind disturbance at 1 AU. The energy estimates as well as the transit time of the disturbance are also in good agreement with numerical models of shock wave propagation in the solar wind. (auth)

12391 MONTE CARLO MODEL OF THE HIGHLY ANISOTROPIC SOLAR PROTON EVENT OF 20 APRIL 1971. Palmer, I. D. (Oral Roberts University, Tulsa, Okla. 74102, USA); Palmeira, R. A. R. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)); Allum, F. R. (Texas Univ., Dallas (USA)). Sol. Phys.; 40: No. 2, 449-460(Feb 1975).

The anisotropy of the particle distribution and its variation with time at 1 AU early in a solar cosmic-ray event can provide information on the pitch-angle scattering of the particles in the

interplanetary medium. The proton event of 20 April 1971 is described in which the anisotropy of the 7.6 to 55 MeV energy channel remained large (≳100%) and field-aligned well into the decay phase of the event. A Monte Carlo technique, which gives the pitch-angle distribution, is employed to investigate two models put forward to explain this sustained anisotropy. It is shown that the observed event is consistent with one model in which the injection of particles at the Sun decayed with an e-folding time of 7 hr. In this model the parallel propagation is determined by small-angle scattering in a diverging field equivalent to a uniform diffusion coefficient of 2.1×10^{22} cm^2 s^{-1} (the corresponding classical mean free path is 0.90 AU). A model with impulsive injection and in which $\kappa(r)$ increases strongly with distance from the Sun cannot satisfactorily explain the observations. (auth)

12392 SOLAR-INTERPLANETARY MODELING: 3-D SOLAR WIND SOLUTIONS IN PRESCRIBED NON-RADIAL MAGNETIC FIELD CONFIGURATIONS. Durney, B. R. (National Center for Atmospheric Research, Boulder, Colo. (USA)); Pneuman, G. W. (High Altitude Observatory, Boulder, Colo. (USA)). Sol. Phys.; 40: No. 2, 461-485(Feb 1975).

A model is presented which describes the 3-dimensional non-radial solar-wind expansion between the Sun and the Earth in a specified magnetic field configuration subject to synoptically observed plasma properties at the coronal base. In this paper, the field is taken to be potential in the inner corona based upon the Mt. Wilson magnetograph observations and radial beyond a certain chosen surface. For plasma boundary conditions at the Sun, deconvoluted density profiles obtained from synoptic K-coronameter brightness observations are used. The temperature is taken to be 2×10^6 K at the base of open field lines. For a sample calculation, data taken during the period of the 12 November 1966 eclipse are employed. Although qualitative agreement with observations at 1 AU is obtained, important discrepancies emerge which are not apparent from spherically symmetric models or those models which do not incorporate actual observations in the lower corona. These discrepancies appear to be due to two primary difficulties — the rapid geometric divergence of the open field lines in the inner corona as well as the breakdown in the validity of the Spitzer heat conduction formula even closer to the Sun than predicted by radial flow models. These two effects combine to produce conductively dominated solutions and lower velocities, densities, and field strengths at the Earth than those observed. The traditional difficulty in solar-wind theory in that unrealistically small densities must be assumed at the coronal base in order to obtain observed densities at 1 AU is more than compensated for here by the rapid divergence of field lines in the inner corona. For these base conditions, the value of β (ratio of gas pressure to magnetic pressure) is shown to be significantly greater than one over most of the lower corona — suggesting that, for the coronal boundary conditions used here, the use of a potential or force-free magnetic field configuration may not be justified. The calculations of this paper point to the directions where future research on solar-interplanetary modelling should receive priority: (a) better models for the coronal magnetic field structure (b) improved understanding of the thermal conductivity relevant for the solar wind plasma. (auth)

12393 SOLAR WIND: THE QUASI-RADIAL APPROXIMATION AND ITS LIMITATIONS. Suess, S. T.; Nerney, S. F. (National Oceanic and Atmospheric Administration, Boulder, Colo. (USA)). Sol. Phys.; 40: No. 2, 487-499(Feb 1975).

The mathematical basis for approximating the solar-wind expansion as nearly radial is examined and defined, removing earlier restrictions thought to occur in the presence of a magnetic field and large variations in latitude. The equations and side conditions governing quasi-radial flow are derived and solved for a simple example to illustrate how this technique can be used for global models of the solar wind. (auth)

12394 A NEW HIGH-SPEED SOLAR SPECTROGRAPH FOR METER AND DECAMETER WAVELENGTHS. Mosier, S. R.; Fainberg, J. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center). Sol. Phys.; 40: No. 2, 501-509(Feb 1975).

A new high-speed digital solar radio spectrograph has been designed and is being operated at the Clark Lake Radio Observatory in California. The spectrograph design attempts to optimize sensitivity, dynamic range, and frequency–time resolution while utilizing modern high-speed computer data-handling techniques. The system is described and initial data observations are presented. (auth)

12395 HIGH n EMISSION AND ABSORPTION LINES OF THE SUN. II. Greve, A. (Max-Planck-Institut fuer Radioastronomie, Bonn (F. R. Germany)). Sol. Phys.; 40: No. 2, 329-331(Feb 1975).

Considering the electronic pressure broadening of high n solar recombination lines, an upper wavelength limit of the observable region of possible lines is derived. The reason that no lines have been observed is discussed. (auth)

12396 ACOUSTIC WAVES AND THE GEOMETRIC SCALE IN THE SOLAR ATMOSPHERE. Deubner, F. L. (Fraunhofer-Institut, Freiburg, F. R. Germany). Sol. Phys.; 40: No. 2, 333-335(Feb 1975).

In a recent paper (Paper I, Deubner, 1974) the present author investigated velocity fluctuations in different spectral lines on the quiet solar disk, and from a large statistical sample derived significant phase differences among the different layers where these lines are formed. Consequently, the phase differences were used to calculate geometric heights for these layers, taking advantage of the fact that the velocity of propagation of sound waves is well known and fairly constant throughout the photosphere and chromosphere. The underlying assumption, namely that the velocity fluctuations observed are caused by vertically travelling sound waves was justified mainly by using in the analysis only the "high frequency tail" in the κ, ω diagram of the fluctuations (4.2×10^{-2} s$^{-1} \leq \omega \leq 5.2 \times 10^{-2}$ s^{-1}), where acoustic waves do propagate, and where the phase and group velocity can be expected to be equal. Taking the data of paper I an χ, t diagram of the velocity and intensity fluctuations from a narrow section (about 9″ wide) of the region observed (224″), which shows a particular event well traceable from the bottom of the photosphere to the Hα layer has been plotted. (auth)

12397 AN EXAMPLE OF A FUNDAMENTAL TYPE IIIb RADIO BURST. Stewart, R. T. (Commonwealth Scientific and Industrial Research Organization, Epping (Australia). Div. of Radiophysics). Sol. Phys.; 40: No. 2, 417-419(Feb 1975).

A convincing example of a fundamental IIIb burst is given, which shows an inverted-U burst with intense striae in the fundamental component superimposed on a fainter continuous background burst. The striae occur on both the up and down strokes of the U-burst and have a similar duration to the background burst. (The striae do not occur at the same frequencies on the up and down strokes.) Each stria has a narrow bandwidth and no measurable frequency drift. In contrast to the fundamental, the harmonic does not have striae. This example clearly demonstrates that striae can occur within a fundamental Type III burst but not within the corresponding second harmonic burst, and it strongly supports the claim that the IIIb precursor in a IIIb–III pair is no more than the fundamental component of a harmonic Type III pair. (auth)

12398 CHROMOSPHERIC SPICULE INCLINATION RELATED TO THE NORMAL AT THE SOLAR SURFACE. Mouradian, Z. (Observatoire de Paris, Section de Meudon, 92 (France)). Compt. Rend., Ser. A, B; 279: No. 26, 683-685(23 Dec 1974). (In French).

The real spatial distribution of angles is calculated from the distribution observed for spicule inclinations related to the normal at the edge of the solar disc. (FR)

12399 MODELS OF SOLAR GRANULAR STRUCTURE AND THE INTERPRETATION OF PHOTOSPHERIC OBSERVATIONS. Keil, S. L. Boston; Boston Univ. Graduate School (1974). 235p. University Microfilms Order No. 74-26,459.

Thesis (Ph. D.).

The standard, one-dimensional, calculations are outlined, and the observations which indicate that these calculations can be misleading are reviewed. The problems of radiative transfer in a two-dimensional, two-component atmosphere are discussed and using a two-dimensional solution of the transfer equation the limitations on the possible structure and magnitude of horizontal temperature fluctuations are calculated using the observed root-mean-square (rms) brightness distribution as a boundary condition. Possible effects of the weak solar magnetic field on the granulation pattern are computed, and it is argued that anisotropy may be introduced into the granular structure by this field. Examine the possible physical interpretations of the granular models which were presented. (Diss. Abstr. Int., B)

12400 LONG-TERM GROUPS IN OBSERVED SERIES OF SOLAR ACTIVITY. Romanchuk, P. R.; Sergeeva, A. N. (Astronomical Observatory, Kiev). Astrometriya Astrofiz.; No. 24, 107-114(1974). (In Russian).

Statistical relations are studied between the observed sunspot numbers W and relative ones formed by long- and short-term groups for the 19th and 20th cycles. These relations are used to predict W for the next month. A record of W for 1967–1971 and forecast for 1970–1972 are given. (5 figures, 6 tables) (auth)

12401 SOLAR ENERGETIC PARTICLE EVENT WITH ^{3}He/^{4}He > 1. Balasubrahmanyan, V. K. (National Aeronautic and

Space Administration, Greenbelt, MD); Serlemitsos, A. T. Nature (London); 252: No. 5483, 460-462(6 Dec 1974).

Some observations on an unusual solar event that occurred on May 28th 1969, made with Goddard cosmic-ray telescopes on the satellite OGO-V, are described. The flare associated with the event was of importance 1B. About 600 ^{3}He nuclei were detected and ^{3}He/^{4}He = 1.52 ± 0.1 in the energy range 4 to 80 MeV/N, which is the highest ratio so far reported for any solar event. The ratio of H to He was also highly unusual, with ^{1}H/(^{3}He + ^{4}He) = 1.00 ± 0.05. The energy spectra of the components were all consistent with power laws. A theory dealing with the production of ^{2}H, ^{3}H, and ^{3}He in solar events is discussed, and extended to the case of the very high ^{3}He/^{4}He ratio. (UK)

12402 SOLAR WIND ACCESS TO THE PLASMA SHEET ALONG THE FLANKS OF THE MAGNETOTAIL. Bird, M. K. (Univ., Bonn). Planet. Space Sci.; 23: No. 1, 27-40(Jan 1975).

Low-energy particle trajectories in an idealized magnetotail magnetic field are investigated to determine the accessibility of magnetosheath protons and electrons to the plasma sheet along the flanks of the tail magnetopause. The drift motion of the positively (negatively) charged particles incident on the dawn (dusk) magnetotail flank causes such particles to penetrate deeper into the magnetotail. For certain combinations of particle energy, incident vector and initial penetration point on the tail magnetopause, the incident particles can become trapped in the plasma sheet, after which their net drift motion then provides a current capable of supporting the entire observed magnetotail field. The results further indicate that the bulk of the solar-wind plasma just outside the distant tail boundary, which streams preferentially in a direction along the magnetopause away from the Earth at velocities around 400 km s^{-1}, can be caught up in the tail if the initial penetration point is within about $2R_E$ of the quasi-neutral sheet. It is suggested that a large fraction of the magnetotail plasma is composed of former solar-wind particles which have penetrated the magnetospheric boundary at the tail flanks. (auth)

12403 EFFECTS OF SOLAR WIND PARAMETERS ON THE DEVELOPMENT OF MAGNETOSPHERIC SUBSTORMS. Murayama, T.; Hakamada, K. (Nagoya Univ., Japan). Planet. Space Sci.; 23: No. 1, 75-91(Jan 1975).

Effects of solar wind parameters on the development of substorms during the events of southward interplanetary magnetic field (IMF) lasting more than one hour were studied. Analysis on 175 events with average magnitude of the southward component of IMF larger than 1.5γ as observed in July to December 1965 lead to the following results: (1) The total auroral electrojet (AEJ) current associated with the southward IMF event is approximately proportional to the time integral of the magnitude of the southward component. (2) The azimuthal component of IMF also affects the AEJ development. AEJ about twice as intense were observed when IMF was directed duskward than when IMF was directed dawnward. (3) AEJ intensity is strongly affected by the solar-wind velocity during the southward IMF events, the intensity being approximately proportional to the square of the velocity. (4) No indication was found that the angle between the Sun–Earth line and the Earth's dipole axis plays any role on the development of substorms if effects of the solar wind parameters as described above are eliminated. (auth)

12404 ORIGIN OF FIFTEEN COSMIC DUST PARTICLES INTERCEPTED BY PIONEER 8 AND 9. Rhee, J. W.; Berg, O. E.; Richardson, F. F.; Auer, S. (National Aeronautics and Space Administration, Greenbelt, MD). Nature (London); 252: No. 5484, 555-556(13 Dec 1974).

Reference is made to the dust particle experiments carried on Pioneer 8 and 9, which have yielded consistent data for more than 8 years. An empirical relationship due to Whipple (Astron. J. 59:201(1954)), the object of which is to distinguish between cometary particles and asteroid objects, is applied to attempts to determine the origin of these dust particles; and a classification is given of 15 cosmic dust particles detected by Pioneer 8 and 9. It is concluded that the majority of the particles showed characteristics of Apollo Group asteroids which originated from residual nuclei of short period comets. (UK)

12405 REDSHIFT DURING PIONEER-6 SOLAR OCCULTATION: UNEXPLAINED OR PREDICTED. Ferencz, C.; Tarcsai, G. (Government Committee on Space Research of Hungary, Budapest). Nature (London); 252: No. 5484, 615(13 Dec 1974).

Comments are offered on papers published on this subject, including Merat and others (Astr. Astrophys. 30:167(1974); Chastel and others (Nature 249:21(1974); Goldstein Science 166:598(1969); Ferencz and Tarcsai (Planet Space Sci. 18:1213(1970), loc. cit. 19:659(1971), and Nature 233:404(1971). (UK)

12406 SOLAR M-REGION PROBLEM: AN OLD PROBLEM NOW FACING ITS SOLUTION. Gulbrandsen, A. (Bergen Univ., Norway). Planet. Space Sci.; 23: No. 1, 143-149(Jan 1975).

The solar M-region problem is briefly reviewed. The Mustel and the Allen–Saemundsson M-region schools are discussed in the light of (a) recent results on coronal structures and solar wind variations, and (b) statistical analyses of coronal–geomagnetic correlations. From this discussion it is suggested that the M-regions should be identified with the central portion of magnetically open solar regions, or coronal holes. With reference to the papers by Gulbrandsen (Phys. Norvegica; 7: 65 (1973) and Planet. Space Sci.; 22: 841 (1974)), it is concluded that such an identification is in fact favored by the great majority of analyses published on the M-region problem during the last 40 yr. It is assumed that historically, the M-region conflict has evolved from the scientific peculiarity that geomagnetic phenomena which are actually related to magnetically open structures, were generally not studied in relation to such structures, but to closed magnetic configurations. (auth)

12407 SOURCE FOR HYPERBOLIC COSMIC DUST PARTICLES. Zook, H. A.; Berg, O. E. (National Aeronautics and Space Administration, Houston, TX). Planet. Space Sci.; 23: No. 1, 183-203(Jan 1975).

Earlier analyses of the Pioneer 8 and 9 experimental meteoroid data have shown that the detectors on these two spacecraft are intercepting meteoroids with hyperbolic orbital parameters. It is shown in this paper that these results are entirely consistent with and, indeed, to be expected from other observations of the interplanetary meteoroid complex. Collisional breakup of meteoroids and post-collision radiation pressure modification of their orbits is found to be a sufficient cause for the observed results. Details of the calculations as well as of the results are presented. (auth)

12408 DETERMINATION OF SOLAR IRRADIATION BY ELLIPTICAL INTEGRALS. Berger, A. (Univ. Catholique de Louvain, Belg.). Ann. Soc. Sci. Brux. Ser. I; 89: No. 1, 69-91 (20 Mar 1975). (In French).

Elliptic integrals of the first, second and third kinds were used to determine the analytical form of the solar radiation received at the top of the atmosphere during any astronomical or meteorological season. The formulas obtained which are a generalization and an improvement of the Milankovitch series are valid for any latitude of the earth's surface. The number of terms involved is also reduced: the insolation for astronomical and meteorological seasons can be computed from only six different terms. This research is part of a treatise on the astronomical theory of paleoclimates. (auth)

12409 MEASUREMENTS OF THE VARIATION IN DENSITY OF INTERPLANETARY PLASMA BY RADIOINTERFERENCE METHODS. Stakhanov, I. P. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Dokl. Akad. Nauk SSSR; 220: No. 6, 1310-1311(21 Feb 1975). (In Russian).

By ordinary phase methods it is possible to measure the content of electrons N in a column along the path of a beam. A beat can be formed whose frequency is determined by the difference in phase paths whose magnitude under definite conditions is determined by transients in the solar wind and magnetosphere. It is possible to investigate these transients by radiofrequency methods, since radio communications are maintained with a number of space ships and the Earth. It is shown that the displacement amplitude of the phase difference path is about 1.5 radians, while the phase difference does not exceed 0.01 radian as a result of ionspheric perturbations. (JSR)

12410 ORIGIN OF THE SUNSPOT MODULATION OF OZONE: ITS IMPLICATIONS FOR STRATOSPHERIC NO INJECTION. Ruderman, M. A.; Chamberlain, J. W. (Columbia Univ., New York). Planet. Space Sci.; 23: No. 2, 247-268(Feb 1975).

The measured modulation of cosmic rays deposited in the stratosphere over a sunspot cycle produces an oscillating source of stratospheric NO with an 11-yr (quasi) period. The resulting modulation of ozone over this period is calculated and is shown to give good agreement with available measurements of the time lag, the latitude dependence, and the magnitude of cyclic variations of ozone. This correlated modulation is then used to discuss the effect on ozone of the injection of NO into the stratosphere from artificial sources, viz. a fleet of supersonic transports and nuclear bomb explosions in the atmosphere. (auth)

12411 COMPARISON OF PROCESSES IN THE COMET MRKOS 1957 V WITH THE SOLAR ACTIVITY. Tarashchuk, V. P. (Astronomical Observatory, Kiev). Astrometriya Astrofiz.; No. 24, 102-106(1974). (In Russian).

The light curve and variations in structure of the Comet 1957 V are compared with the solar and geophysical activity and with the solar wind velocity during the observational period of the comet in August–September 1957. (2 figures) (auth)

Galaxies

Refer also to abstracts 12293, 12297, 12308, 12333, 12353, 12444, and 12445.

12412 REDSHIFTS OF MARKARYAN GALAXIES. Teerikorpi, P. (Univ. of Helsinki). Nature (London); 252: No. 5479, 110–111 (8 Nov 1974).

It is stated that redshift data are now available for many Markarian galaxies, and it was thought interesting to find whether the observed peculiarities in the redshifts of QSOs and related emission line objects have counterparts in these smaller redshifts. These galaxies seem to be companies of small redshift bright galaxies, and may possibly show anomalous redshifts. A preliminary survey of the data on nearly 400 redshifts is here presented, and some interesting features are described. The conclusion is reached that compact and nearly compact Markarian objects have anomalous redshifts, consistant with the idea that anomalous redshifts are connected with compact objects. (UK)

12413 APERTURE SYNTHESIS OF THE FORMALDEHYDE ABSORPTION IN THE DIRECTION OF W3. Whiteoak, J. B.; Rogstad, D. H.; Lockhart, I. A. (Commonwealth Scientific and Industrial Research Organization, Epping, Australia). Mon. Notic. Roy. Astron. Soc.; 169: No. 3, 59P–62P(Dec 1974).

Aperture synthesis of the H_2CO absorption in the direction of W3 has been carried out with a resolution of 20″ arc. The absorption against a number of continuum maxima believed to be compact H II regions shows a uniformity in optical depth and velocity. This suggests that the absorption occurs in a single H_2CO cloud rather than in separate clouds associated with the dense dust envelopes of the H II regions. (auth)

12414 HIGH RESOLUTION OBSERVATIONS OF NEUTRAL HYDROGEN IN M31. I. The Overall Distribution. Emerson, D. T. (Cambridge Univ., Eng.). Mon. Notic. Roy. Astron. Soc.; 169: No. 3, 607–629(Dec 1974).

Observations of the galaxy M31 at 21 cm wavelength have been made with the Cambridge Half-Mile telescope, enabling the neutral hydrogen to be mapped with an angular resolution of $1.5' \times 2.2'$ and a velocity resolution of 39 km s^{-1}. The central deficiency of H I is found to extend to 4 kpc from the nucleus but beyond that distance the H I emission is seen to be strongly associated with dust lanes. The surface densities of H II regions and the youngest OB associations are found to vary approximately as the square of the H I surface density. H I emission along the major axis has been detected to 162′ (32.4 kpc) SW from the nucleus, and to 120′ (24 kpc) NE. (auth)

12415 FORBIDDEN IRON LINES IN NGC 4151. Netzer, H. (Royal Greenwich Lab., Hailsham, Eng.). Mon. Notic. Roy. Astron. Soc.; 169: No. 3, 579–590(Dec 1974).

Weak emission lines in NGC 4151 are identified. Most of them are [Fe II] lines, but new lines of [Fe III], [Fe IV], [Fe V], and [Fe VI] are also present. The excitation of [Fe II] lines is discussed and an upper limit of $T_e = 6 \times 10^3$°K is suggested from the weakness of Fe II permitted lines. Relative emission in different states of ionization of iron suggests that most of the gas in the region emitting forbidden lines is in a low state of ionization and the amount of neutral hydrogen makes the nucleus very optically thick in the Lyman continuum. Disappearance of [Fe X] lines suggests a change in line intensity on a time scale of 3 yr. (auth)

12416 BAUTZ-MORGAN CLASSIFICATION OF CLUSTERS CONTAINING RADIO GALAXIES. McHardy, I. M. (Cambridge Univ., Eng.). Mon. Notic. Roy. Astron. Soc.; 169: No. 3, 527–537(Dec 1974).

Clusters and groups of galaxies containing 3CR and 4C radio sources are classified using the Bautz-Morgan (Astrophys. J.; 162: L 149 (1970)) (BM) system. It is established that powerful radio galaxies occur much more commonly in BM class I clusters than in any other class. As the radio source is usually associated with the optically brightest galaxy in the cluster, it is concluded that in BM class I clusters the integrated radio lifetime of the brightest galaxy is greater than in other classes of cluster. The absolute optical magnitudes and optical spectra of the radio galaxies in clusters do not vary significantly with BM class. This suggests that the preferential occurrence of radio sources in BM class I clusters may be associated with some property of the cluster. (auth)

12417 RE-ANALYSIS OF THE DYNAMICS OF THE NEARBY GROUPS OF GALAXIES. Chincarini, G.; Rood, H. J.; Welch, G. A. (Texas Univ., Austin). Mon. Notic. Roy. Astron. Soc.; 170: No. 3, 441–445(Mar 1975).

A new analysis of the dynamics of the groups of galaxies listed by de Vaucouleurs has been made using new radial velocities and corrections for observational error. The finding of Turner and Sargent (Astrophys. J.; in press) that groups tend to cluster around two peaks on an expansion-rate histogram is confirmed. If these classes are identified as representing bound and unbound groups, then the similarity in slope of their regression lines on a plot of log (M_{VT}/M_L) vs log V_D provides evidence that this correlation lacks cosmological significance. (auth)

12418 RADIO STRUCTURE OF THE M87 JET. Wilkinson, P. N. (Nuffield Radio Astronomy Labs., Jodrell Bank, Eng.). Nature (London); 252: No. 5485, 661–663(20 Dec 1974).

The results of interferometer observations of the M87 jet at 408 and 1666 MHz, with resolving powers ≈0.5″, are reported, giving details of its fine structure. Details are given of the interferometer used. The position of the radio nucleus was determined and found to be within 0.5″ in right ascension and 2″ in declination of the optical nucleus, in agreement with earlier radio position measurements. The results indicate that the electrons responsible for the radio and optical synchrotron emission have very similar spatial distributions, but further high resolution studies are required before the radio observations can place important constraints on theories of the jet. (UK)

12419 OBSERVATIONS OF M87 AT 5 GHz WITH THE 5-km TELESCOPE. Turland, B. D. (Cambridge Univ., Eng.). Mon. Notic. Roy. Astron. Soc.; 170: No. 2, 281–294(Feb 1975).

M87 has been observed at 5 GHz with the 5-km telescope at Cambridge. Maps of total intensity and polarized flux were made of the core component with a beam of $2'' \times 9''$ arc. Compact structure, corresponding to knots in the optical jet, was found in the Np component. The knots are significantly polarized (~10 per cent) at 5 GHz and models of the jet with particle densities $\geq 10^6 m^{-3}$ are shown to be no longer tenable. The Sf component is more extended and contains no compact features. The nuclear source of flux density 4.0×10^{-26} W m^{-2} Hz^{-1} was unresolved, but has an extension in the direction of the jet, and possibly in p.a. 170°. The x-ray emission from M87 is most easily explained as thermal bremsstrahlung from an extended hot gas, which probably has sufficient pressure to confine the extended components of the radio source but not the knots in the jet. As particle acceleration is required in the knots to account for the optical emission, a model in which fast particles and magnetic fields escape from the knots at speeds comparable with that of light is proposed. It is shown that there is a sufficient energy supply for the more extended components of the source. No further energy production or particle acceleration is required either in the core or in the halo, the latter being probably a relic of earlier activity. The spectra of the various components are consistent with this explanation which implies that there has been activity at the current level for the past 10^8 year or so. (auth)

12420 OBSCURATION IN AND AROUND THE SMALL MAGELLANIC CLOUD. MacGillivray, H. T. (Univ. of Edinburgh). Mon. Notic. Roy. Astron. Soc.; 170: No. 2, 241–249(Feb 1975).

The detailed distribution of the obscuration in and around the Small Magellanic Cloud is discussed in the light of recently obtained galaxy counts. Several regions of high absorption are detected. Star masking is taken into account in the determination of the absorption profile across the Cloud. Comparison with the neutral hydrogen profile reveals that the extinction coefficient is less than in the Galaxy, indicating a lower ratio of dust to gas. (auth)

12421 POSSIBLE NEW SEGMENT OF THE MAGELLANIC STREAM IN THE NORTHERN SKY. Cohen, R. J.; Davies, R. D. (Nuffield Radio Astronomy Labs., Jodrell Bank, Eng.). Mon. Notic. Roy. Astron. Soc.; 170: No. 2, 23P–27P(Feb 1975).

A new high-velocity neutral hydrogen feature has been discovered at RA = 02h 30m, Dec. + 9.5° ($l = 160°$, $b = -46°$) at a velocity of −334 km s^{-1} relative to the lsr. Its properties are similar to those of the adjacent parts of the Magellanic Stream and it is suggested that this new feature is part of the same phenomenon. (auth)

12422 ABSENCE OF DETECTABLE FORMALDEHYDE IN THE DIRECTION OF CENTAURUS A. O'Connell, R. W.; Saslaw, W. C.; Turner, B. E. (Univ. of Virginia, Charlottesville). Mon. Notic. Roy. Astron. Soc.; 170: No. 2, 29P–30P(Feb 1975).

A report is presented on an upper limit to formaldehyde absorption or emission in the direction of the prominent dust lane of NGC 5128. Since it is conceivable that the lane is a foreground object, a search has been made at both local and systemic velocities. The upper limit to the mean optical depth in cold H_2CO toward the central continuum source of the galaxy is 0.02. (auth)

12423 POSITIONAL AGREEMENT BETWEEN 3U1706+32 AND THE CLUSTER OF GALAXIES A2241. Bahcall, N. A. (Princeton Univ., NJ). Nature (London); 252: No. 5485, 661(20 Dec 1974).

Attention is called to the existence of a rich cluster of galaxies in the error box of the Uhuru high galactic latitude source 3U1706 + 32. This cluster, referred to as Abell 2241, is located at 16h 57.8 min. + 32°37′, and shows an estimated redshift $z \approx 0.07$. It is suggested that this cluster should be added as a possible identification to the list of clusters that have been tentatively identified with x-ray sources, but a much improved x-ray position is required before a positive identification can be made. (UK)

12424 GALACTIC MODEL II: THE GRAVITATIONALLY RADIATED ANGULAR AND LINEAR MOMENTA FLUXES. Booth, D. J. (Hudderfield Polytechnic, Eng.). Int. J. Theor. Phys.; 10: No. 5, 333-353(Sep 1974).

Using the linearized theory of general relativity the gravitationally radiated angular and linear momenta from a galactic model of N gravitational radiators is calculated. The results are presented in terms of the lowest order contributing multipole moments (quadrupole), the orientations of the radiators about a common reference frame, the distances between pairs of radiators and the frequency of each radiator. This work is a continuation of an earlier work in which the galactic model was first proposed and its gravitationally radiated energy flux was computed. (auth)

12425 POLYOXYMETHYLENE POLYMERS AS INTERSTELLAR GRAINS. Wickramasinghe, N. C. (Western Ontario Univ., London, Canada). Mon. Notic. Roy. Astron. Soc.; 170: No. 1, 11P-16P(Jan 1975).

Formaldehyde molecules in interstellar dust clouds condense on interstellar silicate grains as polyoxymethylene whiskers. A significant fraction of interstellar O and C atoms may be frozen on to grains in this form, and this material could be responsible for a major part of the observed extinction and polarization of starlight at optical wavelengths. Polyoxymethylene grains have a spectral band in the wavelength region 8 to 12μ, similar to that observed in stellar spectra. (auth)

12426 ALIGNMENT OF INTERSTELLAR DUST CLOUDS AND THE DIFFERENTIAL Z-FIELD OF THE GALAXY. Disney, M. J.; Hopper, P. B. (Australian National Univ., Canberra). Mon. Notic. Roy. Astron. Soc.; 170: No. 1, 177-184(Jan 1975).

The gradient of the z component of the gravitational field of the galactic disc exerts a differential force across a dust cloud which will be sufficient to squeeze the clouds into disc-like shapes with their long axes parallel to the galactic plane. This is suggested as a possible explanation for the observed alignments of dust clouds. (auth)

12427 21 CM OBSERVATIONS OF HOT NEUTRAL INTERCLOUD GAS. Davies, R. D.; Cummings, E. R. (Nuffield Radio Astronomy Labs., Jodrell Bank, Eng.). Mon. Notic. Roy. Astron. Soc.; 170: No. 1, 95-113(Jan 1975).

Observations of the 21 cm neutral hydrogen absorption spectra of the strong radio sources Vir A, Cyg A, and Cas A have been taken with the Mark IA radio telescope. Cloud and intercloud gas can be identified in these absorption spectra and in adjacent emission spectra. The observed values of the spin temperature of the hot intercloud gas are in the range 600 to 8000 K; the corresponding kinetic temperature range is $T_k = 770$ to $\lesssim 10{,}000$ K. There is evidence for an increase of T_k with height above the galactic plane. Some implications of these first direct observations of the temperature of the neutral intercloud gas are discussed. (auth)

12428 BLACK DWARF STARS AS MISSING MASS IN CLUSTERS OF GALAXIES. Napier, W. M.; Guthrie, B. N. G. (Royal Observatory, Edinburgh). Mon. Notic. Roy. Astron. Soc.; 170: No. 1, 7-14(Jan 1975).

The missing mass in clusters of galaxies may be largely in the form of degenerate low-mass stars (black dwarfs) with masses down to $10^{-2}M_\odot$. Such stars may have formed in large numbers in globular clusters assembled as protogalaxies. The globular clusters became partially relaxed and developed halos of low-mass stars. The halo stars were removed by tidal shocks and escaped preferentially from the protogalaxies during collapse. Protogalaxies may have lost nearly half their mass in this way. The resulting elliptical galaxies have massive halos of black dwarfs which may be removed later by tidal interaction with other galaxies. Clusters of galaxies retain most of their black dwarfs, so that the virial mass-to-light ratios of clusters are much higher than the mass-to-light ratios of the nuclear regions of individual elliptical galaxies. (auth)

12429 GALAXIES. Kohler, P. (Observatoire de Paris, Section de Meudon, 92 (France)). Sci. Avenir; No. 333, 1047-1056, 1065(Nov 1974). (In French).

Our galaxy is made up essentially of stars and of interstellar matter concentrated in the spiral arms of the galactic plane. It is believed to have the shape of a disc swollen in the center, the swelling being an ellipsoid of dimensions 26000 by 13000 light years and the diameter of the system being 100000 light years. The accumulations of galaxies are studied and classified. Theories on galaxy birth and evolution, quasars and galactic nuclei are then examined. (FR)

12430 INCLINATION OF THE ZODIACAL CLOUD ON THE ECLIPTIC. Robley, R. (Observatoire du Pic du Midi, 65-Bagneres-de-Bigorre (France)). Compt. Rend., Ser. A, B; 279: No. 25, 613-616(16 Dec 1974). (In French).

The annual variation observed towards the ecliptic pole is interpreted as due to the inclination of the zodiacal cloud on the ecliptic, and the decay rate in the dust density perpendicularly to the ecliptic is deduced. With a flattening of the cloud of tenth order, the plane of symmetry of the cloud is shown not to coincide with the equatorial plane. (FR)

12431 OBSERVATIONS OF THE RADIO GALAXY DA240 AT 11 CM. Baker, J. R.; Preuss, E.; Whiteoak, J. B.; Zimmermann, P. (Max-Planck-Institut fuer Radioastronomie, Bonn). Nature (London); 252: No. 5484, 552-553(13 Dec 1974).

It is stated that the radio source DA 240 has been identified as a 15 mag elliptical galaxy with redshift $z = 0.0356$, placing it at a distance of 215 Mpc. Its total angular extent is ~34′, implying a linear extent of 2.1 Mpc and making it one of the largest systems known. As part of a program of source polarization measurements using the Effelsberg 100m telescope the polarization and total density distribution across the source were mapped at a wavelength of 11 cm and resolution 4.8′. The map was constructed from sets of right ascension scans, and covered observations of the NE component, the central component, and the SW component. Results are discussed. (UK)

12432 DETERMINATION OF THE MASSES OF DISK GALAXIES USING THE DENSITY-WAVE MODEL OF THEIR SPIRAL STRUCTURE: M 31 AND M 33. Basu, B. (Jadavpur Univ., Calcutta). Bull. Astron. Inst. Czech.; 26: No. 1, 48-57(1975).

By using the density-wave solutions of the gas-dynamical equations in two-dimensional cylindrical coordinates, the surface density distributions of matter can be expressed in terms of several galactic parameters in spiral galaxies. By using the numerical values of the parameters involved that are appropriate for each separate galaxy, the density values can be evaluated along the radial distances, except at regions quite close to the center. These density values can then be fitted to suitable algebraic laws over different appropriate regions of each galaxy, and the masses of the corresponding regions can be evaluated separately by integration. By adding these masses, together with a reasonable mass for the central part, the total mass of a galaxy can be determined. By means of this procedure the masses of M 31 and M 33 were evaluated to be between 3.8×10^{11} $M_\odot$ and 4.53×10^{11} $M_\odot$ and between 1.45×10^{10} $M_\odot$ and 1.66×10^{10} $M_\odot$, respectively. These masses are within reasonable ranges for the masses of these galaxies as variously determined by other authors. (2 figures, 4 tables) (auth)

12433 FORMALDEHYDE POLYMERS IN INTERSTELLAR SPACE. Wickramasinghe, N. C. (University Coll. of South Wales, Cardiff, Eng.). Nature (London); 252: No. 5483, 462-463 (6 Dec 1974).

It is thought that silicate grains exist in envelopes of dust around some cool stars, and it is suggested that formaldehyde molecules, which have been detected in many interstellar clouds, may condense on to the silicate grains. Such condensation at temperatures ≤ 20K is attended by chain polymerisation resulting in the formation of crystalline polyoxymethylene as long whiskers. This compound is moderately refractory, with a melting temperature in the range 450 to 500K, and could survive in HII regions and radiate at ≤ 500K, thus accounting for many galactic infrared sources. Furthermore, a cylindrical particle of radius about 1.5×10^{-5} cm, with a probable refractive index of about 1.58, will possess extinction and polarisation properties consistent with interstellar data. It is concluded that POM coated grains must be regarded as a strong candidate for the main component of interstellar grains, and that interstellar grains consist of a mixture of small graphite particles and silicate particles coated with POM. The graphite and silicate particles are ejected from cool giant stars. (UK)

12434 THEORY OF NON-STATIONARY RELATIVISTIC SHOCK WAVES IN INHOMOGENEOUS COSMIC MEDIUM. Novak, A. F. (Kiev State Inst. of Cultivation). Astrometriya Astrofiz.; No. 24, 53-55(1974). (In Russian).

Whithem's method, known in gasdynamics, is generalized for the case of nonstationary spherical relativistic shock wave. A

differential equation of the shock strength is derived. Formulae of the relativistic shock parameters are discussed. (auth)

12435 FAR INFRARED BACKGROUND ASTRONOMY AT GROUND. Dall'Oglio, G.; Fonti, S.; Guidi, I.; Melchiorri, B.; Melchiorri, F.; Natale, V. (TESRE/CNR Lab., Florence). Nuovo Cim.; 27B: No. 1, 27-40(11 May 1975).

The possibility of detecting diffuse sky radiation in the (250 to 3000) μm range is discussed on the basis of recent measurements performed at the mountain observatory of Testa Grigia (3500 m a.s.l.) on the atmospheric emission and on the atmospheric noise. It is shown how, in many cases, the limits assigned by the residual atmospheric emission are well below the sensitivity of the available infrared detectors; as a consequence some new experiments of background astronomy are suggested. (auth)

Cosmology

12436 COSMOLOGICAL EFFECTS OF PRIMORDIAL BLACK HOLES. Chapline, G. F. (Univ. of California, Livermore). Nature (London); 253: No. 5489, 251-252(24 Jan 1975).

It is stated that although only black holes with masses $\gtrsim 1.5 M_{\odot}$ are expected to result from stellar evolution black holes with much smaller masses may be present throughout the Universe, as a result of density fluctuations in the very early Universe. Such fluctuations on very large mass scales were certainly present in the early Universe, as evident from the irregular distribution of galaxies. Evidence of density fluctuations on scales smaller than galaxy size is thought to have been destroyed during the era of radiation recombination, but fluctuations of intermediate size may be "fossilized" in the form of black holes. Observations of black holes, and particularly those with masses $M < M_{\odot}$, could provide information concerning conditions in the very early Universe. An indication that many black holes exist at present in the Universe is evidence that the average density of matter in the Universe greatly exceeds the observed density. The cosmological effects of primordial black holes are discussed. If many small black holes exist at the present time their presence may be revealed since they emit electromagnetic radiation; masses smaller than $\sim 10^{20}$ g will radiate x rays and γ rays when they undergo gravitational collapse. It is estimated that there may be as many as 10^{33} small black holes per galaxy, and a region the size of the Solar System may contain several small black holes. Estimates are made of the contribution of small black holes to the total mass of the Universe. Small black holes in the Solar System might be interesting as power sources. (UK)

12437 FLAT ANISOTROPIC MODELS OF THE UNIVERSE WITH TORSION AND WITHOUT SINGULARITY. Kuchowicz, B. (Univ., Warsaw). J. Phys., A (London); 8: No. 3, L29-L31(Mar 1975).

The intrinsic angular momentum of the cosmological substratum is able to prevent the appearance of the cosmological singularity in the Einstein–Cartan theory. Conditions for this to occur in Bianchi type I cosmologies are given, and several new cosmological models whose anisotropy diminishes with expansion are explicitly constructed. (auth)

12438 BLACK-AND-WHITE HOLES. Goldoni, R. (Scuola Normale Superiore, Pisa, Italy). Gen. Relativity Gravitation; 6: No. 1, 103-113(Feb 1975).

From 7th international conference on gravitation and relativity; Tel-Aviv, Israel (Jun 1974).

An analysis of the complete Schwarzschild manifold M is performed. The Finkelstein time is assumed to order the events causally, instead of the Kruskal time. As a consequence of this assumption, the mutual causal behavior of the four Schwarzschild regions contained in M allows one to conceive of a dynamical mechanism which could produce the main features of M in some region of space–time. Assuming the strong principle of equivalence, one predicts a significant blue shift of the radiation emitted by matter emerging from the $r = 0$ singularity. This phenomenon has not been observed. A way to reconcile the assumption that M is physical with the absence of blue shifts is to require only a weaker equivalence principle, namely the local validity of the principle of (special) relativity in any local inertial frame. From such an equivalence principle, which one cannot renounce without giving up the whole theory of relativity, it is possible to deduce the ratio between the frequencies (as measured by an observer at rest in the asymptotically flat domain) emitted by two identical transmitters at the Schwarzschild times at which they reach the same 3-space point of the exterior Schwarzschild region along different geodesics. A physical interpretation of the peculiar feature of M of being the union of four regions with an infinite space-like extension is suggested. Such an interpretation is mainly based on a general relativity generalization of the space–time previously introduced in the special relativity theory of superluminal frames. (auth)

12439 NEW PRIMARY DYNAMO MECHANISM. Reinhardt, M.; Rosenblum, A. (Univ., Bochum, Ger.). Gen. Relativity Gravitation; 6: No. 1, 71-73(Feb 1975).

From 7th international conference on gravitation and relativity; Tel-Aviv, Israel (Jun 1974).

A new primary dynamo mechanism for the generation of cosmic magnetic fields in a plasma surrounding a rotating body is discussed. The mechanism has been used to estimate the magnetic fields generated by super-massive black holes in intergalactic space and in the nuclei of galaxies, super-massive stars, neutron stars, and black holes of stellar mass but in all cases the effect is rather weak. (UK)

12440 CORRECTION OF A MISUNDERSTANDING ABOUT OLBER'S PARADOX. Belinfante, F. J. (Purdue Univ., Lafayette, IN). Gen. Relativity Gravitation; 6: No. 1, 9-12(Feb 1975).

From 7th international conference on gravitation and relativity; Tel-Aviv, Israel (Jun 1974).

It is sometimes said that, if the Universe were not expanding, we all would burn up (Olbers' paradox). In order to check on this, a solution of Friedmann's equation has been used that seems reasonable, and that predicts a contraction of the Universe after it has reached a maximum size. The radiation energy density U_n now at age t_n of the Universe can then be compared with this density ($= U^*$) at a time t^* during contraction when $R(t)$ takes a value R^* equal to its present value R_n. (auth)

12441 SPATIAL DISTRIBUTION AND COSMOLOGICAL EVOLUTION OF SCINTILLATING RADIO SOURCES. Readhead, A. C. S.; Longair, M. S. (Cambridge Univ., Eng.). Mon. Notic. Roy. Astron. Soc.; 170: No. 2, 393-404(Feb 1975).

An analysis of the scintillation properties of complete samples of extragalactic radio sources indicates; (i) there exists a correlation between compact physical structure and high radio luminosity and redshift once allowance is made for several observational selection effects. (ii) Strongly scintillating radio sources exhibit strong cosmological evolution of the form inferred for quasars and powerful radio sources in general. The strong evolutionary effects are found in samples of both 3CR and 4C radio sources. (iii) Strongly scintillating radio galaxies exhibit strong cosmological evolution as previously inferred by Schmidt. (auth)

12442 PREFERRED FRAMES AND OSCILLATING UNIVERSES. Katz, J. (Hebrew Univ., Jerusalem). Int. J. Theor. Phys.; 10: No. 3, 165-173(Aug 1974).

A metric theory of gravitation is presented. It is based on the existence of a preferred "cosmic" time. It agrees with all present experimental facts regarding gravitation and leads to singularity-free oscillating universes. (auth)

12443 EXTRAGALACTIC X-RAY SOURCES AND THE X-RAY BACKGROUND. Rowan–Robinson, M. (Queen Mary Coll., London); Fabian, A. C. Mon. Notic. Roy. Astron. Soc.; 170: No. 1, 199-217(Jan 1975).

Identifications with a relatively complete sample of high-latitude x-ray sources, including four new identifications with Abell clusters, are used to establish the luminosity function for extragalactic sources, and to determine the maximum rates of evolution for different populations of source consistent with the observed integrated x-ray background. A significant limit is obtained on any evolution that operates on all sources. Without evolution, quasars, and radio and normal galaxies, make a negligible contribution to the background. Seyferts may contribute about 30 per cent, but with an uncertainty of the same order. Rich clusters contribute about 10 per cent, but make up over 80 per cent of the identifications. Both inverse Compton and thermal Bremsstrahlung models of cluster sources are investigated and severe restrictions can be placed on models of Silk & Tarter, in which a strong correlation of x-ray luminosity with richness is predicted. Skepticism is expressed of reported correlations of the x-ray luminosity of clusters with radio luminosity or morphological type. (auth)

12444 COMETS. Dobrovolsky, O. Recherche (Paris).; 6: No. 53, 98-107(Feb 1975). (In French).

A coherent model for comet structure and the phenomena involved is beginning to be obtained from the studies effected for ten years, especially from two new techniques: the development of artificial satellite observations and the in-laboratory reconstitution of the processes affecting comets. (FR)

12445 RETARDED CORES, BLACK HOLES, AND GALAXY FORMATION. Gribbin, J. Nature (London); 252: No. 5483, 445-447(6 Dec 1974).

Recent astronomical observations have given rise to suggestions that black holes may reside at the centers of many or all galaxies.

The evidence remains equivocal; and in the meantime there is a theoretical variation on this theme, in which galaxies grow on retarded cores, "white holes", which have been present since the initial "big bang". (auth)

12446 GRAVITATIONAL SEARCHLIGHT AND ITS ASTROPHYSICAL APPLICATIONS. Chitre, S. M. (Tata Inst. of Fundamental Research, Bombay); Narlikar, J. V.; Kapoor, R. C. Nature (London); 252: No. 5483, 460(6 Dec 1974).

An interesting effect associated with light emitted in the forward direction by a source circulating in an equatorial plane around a highly collapsed object or a black hole is pointed out. Under appropriate conditions the light is blueshifted to a distant observer, and very high blueshifts are observed as the orbit tends to the so called "unstable circular orbit". The results can be qualitatively understood in terms of competition between the Doppler blueshift of forward light emission and the gravitational redshift due to the central mass. The former increases much more rapidly than the latter as orbits become close to the "unstable circular orbit". Some astrophysical considerations are discussed, and the effect is referred to as constituting a "gravitational searchlight". (UK)

12447 SIMPLE MODEL OF A FRIEDMANN UNIVERSE FILLED WITH A QUANTISED SCALAR FIELD. Candelas, P. (Oxford Univ.). Nature (London); 252: No. 5484, 554-555(13 Dec 1974).

A simple model related to the occurrence of singularities in a Friedmann cosmology is presented. Using this model analytic solutions can be obtained that should provide a qualitative insight into the results that may be available from a more complete theory. The model represents a "mini-phase space" calculation in which a massive scalar field is quantised in the background geometry of a Friedmann universe. (UK)

12448 LIGHTNING IN ASTRONOMY. Crew, E. W. Nature (London); 252: No. 5484, 539-542(13 Dec 1974).

It is suggested that evidence for lightning on a grand scale in astronomy is most convincing. It might explain stellar flares, cosmic jets, quasars, galactic evolution, and much more. In this mode, electrical charges accumulate in apparently highly conducting atmospheres. (auth)

12449 COSMOLOGICAL MODELS OF THE KANTOWSKI–SACHS TYPE. I. Goethals, M. (Univ., Catholique de Louvain, Belg.). Ann. Soc. Sci. Brux. Ser. I; 89: No. 1, 50-62(20 Mar 1975). (In French).

Axially symmetric cosmological models with a metric of Kantowski–Sachs type are considered. The source term is generalized to the case of a perfect fluid having a linear equation of state corresponding to arbitrary sound velocity (less than c). Einstein's equations are reduced to a system of two ordinary differential equations of first order, and the behavior of the solutions in the neighborhood of the singular points of the system are classified. The implications for the cosmological models are discussed. (auth)

12450 SOME PROBLEMS IN MODERN ASTROPHYSICS. Yang, C. (Inst. of Atomic Energy, Peking). Wu-li; 3: No. 4, 221-228(18 Aug 1974).

This paper surveys current research problems in modern astrophysics. Problems mentioned include: (1) redshifts of quasistellar objects and related extragalactic systems, (2) photo mass, quasar redshifts and other abnormal redshifts, (3) gravitational collapse, non-velocity redshifts and photon–photon interactions, and local and cosmological theories of quasars, (4) theory and discovery of neutron stars, (5) white dwarf stars, (6) black holes, and (7) problem of solar neutrinos. (JPRS)

12451 VIOLATION OF CP-INVARIANCE AND STRANGENESS OF A HOT UNIVERSE. Pontekorvo, B. M. (Joint Inst. for Nuclear Research, Dubna, USSR). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 12, 18-23(1974). (In Russian).

The treatment is from the point of view that the universe is symmetrical with respect to baryon charge. This view assumes the existence of antimatter in macroscopic amounts someplace in the universe. Attention is called to the peculiar asymmetry of a hot "neutral" substance (black-body emission at a very high temperature) caused by violation of CP-invariance (a hot universe is assumed). CP-invariance leads to the appearance of a strangeness value different from zero even in a system having the same number of baryons and antibaryons at a very high temperature. One interesting consequence of this view is the appearance of some baryon-antibaryon asymmetry of matter in the universe, even under conditions where the baryon charge is strictly conserved, and where the number of baryons is equal to the number of antibaryons. (SJR)

12452 GENERATION OF PARTICLES FROM A VACUUM IN A NON-STEADY-STATE, ISOTROPIC UNIVERSE. Grib, A. A.; Mamaev, S. G.; Mostepanenko, V. M. (Leningrad State Univ.). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 12, 79-84(1974). (In Russian).

The generation of particles from a vacuum in closed, open and quasieuclidean models of Friedman is considered. Finite general expressions are obtained for the density of the number of pairs being generated, and also new analytical estimates are obtained for the intensity of generative processes in the early stages of the evolution of the universe. (SJR)

12453 RELATIVISTIC INVARIANCE AND THE EXPANSION OF THE UNIVERSE. Bergstroem, A. (Univ. of California, Berkeley). Nuovo Cim.; 27B: No. 1, 145-160(11 May 1975).

Assuming the propagation of electromagnetic quanta to be governed by a rigorous continuity equation, it is shown that the requirement that this equation have the form of the usual Lorentz-covariant electromagnetic wave equation in vacuum implies properties of space-time which an observer is likely to describe as a uniform expansion in agreement with Hubble's law. By this approach the interference properties of quanta are also derived. The possible small-scale variations of the Hubble constant, suggested by observations of some extra-galactic objects, would with this interpretation of the galactic redshift appear less mysterious. (auth)

12454 COSMOLOGICAL TERM, COMPENSATION, AND SINGULARITIES. Ivanenko, D. D. (Moscow State Univ.). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 12, 35-42(1974). (In Russian).

Emphasis is placed on the necessity of a cosmological term in Einsteinian and other gravitational theories, among which the greatest theoretical use is the "compensation" treatment of the gravitational field as a measuring standard leading in particular to bending and nonlinearities for spinor and other fields. In this regard it is pointed out that it is important to take into account bare singularities and that it is fit to maintain analogies with the latest models of elementary particles. (SJR)

Planetary Phenomena

Refer also to abstracts 12444 and 13008.

12455 RECENT INCREASE IN JUPITER'S DECIMETRIC RADIO EMISSION. Klein, M. J. (Jet Propulsion Lab., Pasadena, CA). Nature (London); 253: No. 5487, 102-103(10 Jan 1975).

It is stated that during observations in support of a study of the linear polarisation of Jupiter's decimetric radio emission it was noted that the planet's total intensity had increased between 1973 and 1974. This increase was only about 5%, but was a reversal of the trend during the past decade, during which time the emission decreased by 20 to 30%. Measurements were made with the NASA 64m parabolic antenna at Goldstone, California, operating at 2,295 MHz. It is generally believed that variations of Jupiter's decimetric radio emission are related to changes in the properties of the Jovian Van Allen radiation belts, but specific causes of the variability have not been determined. Variations in the intensity of Jupiter's radio emission are relevant to the analysis of particle and field data returned from spacecraft. (UK)

12456 SPECTRA OF THE JUPITER RADIO BURSTS. Ellis, G. R. A. (Tasmania Univ., Sandy Bay, Australia). Nature (London); 253: No. 5491, 415-417(6 Feb 1975).

A description is given of the spectra of Jupiter radio bursts observed during March to September 1973 and 1974 using the Llanherne filled-aperture low-frequency radiotelescope, over the frequency range 4 to 29 MHz. Frequency-time spectra were obtained with a 256 channel real time analyser with channels 10 kHz wide and separated by 10 kHz, or when records with higher frequency resolution or time resolution were wanted a time expansion spectrum analyser with 1500 channels in a 3 MHz bandwidth was used. (UK)

12457 ON THE CHEMICAL COMPOSITION OF THE MOON, JUPITER, METEORITES, AND AM STARS. Drobyshevski, E. M. (AN SSSR, Leningrad. Fiziko–Tekhnicheskij Inst.). Earth Planet. Sci. Lett.; 25: No. 3, 368-378(Apr 1975).

If surface anomalies in the composition of the metallic-line A stars (Am stars) are due to a precipitation of planet-like bodies (planetoids) on them, then one should expect a correlation to exist between the overabundance of heavier-than-iron elements on these stars and their "standard" abundances in the solar system (since chondrites provide the "standard" level for these elements). However, an anticorrelation was revealed. Nevertheless, this fact supports the original suggestion on the origin of the metallicism of A stars, and can easily be explained within the author's hypothesis on the formation of the Sun from matter escaping from the proto-Jupiter. During the terminal stages

of mass transfer, the matter was strongly depleted in refractories (forming the rocky core of Jupiter). Therefore the composition of the meteorites formed should not coincide with the primary composition of the matter. Thus the Sun's outer layers may also have a distorted composition. The author concludes that it is desirable to revise the "standard" abundances of elements heavier than iron. From a comparison of the surface composition of Am stars with the composition of lunar anorthosites and that of rocks in the upper zones of the Skaergaard intrusion (Greenland), the Am phenomenon may be seen to result from a precipitation of large geochemically differentiated planetoids onto a star. Such planetoids (including the Moon) condense in the cooled envelope of the primary component of a close binary stellar system. (auth)

12458 INFLUENCE OF THE POLARITY OF THE INTERPLANETARY MAGNETIC FIELD ON THE ANNUAL AND DIURNAL VARIATIONS OF THE MAGNETIC ACTIVITY. Berthelier, A. (Centre National de la Recherche Scientifique, 94- Saint-Maur-des-Fosses (France). Groupe de Recherches Ionospheriques). Compt. Rend., Ser. A, B; 280: No. 7, 195-198(17 Feb 1975). (In French).

The annual variation of the magnetic activity has a maximum near the spring equinox for a negative polarity, and near the fall equinox for a positive polarity. In both cases, this corresponds to a maximum of the average value of the angle between the dipole axis and the azimuthal component B of the interplanetary magnetic field. The diurnal variation of activity was analyzed in order to confirm that the increase of activity is related to an increase of this angle. Around the equinoxes the maxima indeed occur at the times expected from this hypothesis. Around the solstices, shifts of the times of the maxima that can be explained by the influence of the McIntosh effect, are described. (FR)

12459 PIONEER SOLAR PLASMA AND MAGNETIC FIELD MEASUREMENTS IN INTERPLANETARY SPACE DURING AUGUST 2-17, 1972. Mihalov, J. D.; Colburn, D. S.; Collard, H. R.; Smith, B. F.; Sonett, C. P.; Wolfe, J. H. (Ames Research Center, Moffett Field, CA). pp 545-553 of Correlated Interplanetary and Magnetospheric Observations. Page, D. E. (ed.). Dordrecht; D. Reidel Publishing Company (1974).

Solar wind plasma and magnetic field measurements from Pioneers 9 and 10 during August 2 to 17, 1972, reveal complex and large-amplitude variations on a one-hour time scale and numerous discontinuities. During this time period an approximate radial alignment of the two spacecraft as seen from the sun occurred with heliocentric distances of 0.8 AU for Pioneer 9 and 2.2 AU for Pioneer 10, both at 45° east of the earth's solar longitude. The peak hourly average solar wind proton bulk velocity measured at Pioneer 9 was 990 km s^{-1} during hour 0 UT of August 5. The peak hourly average proton number density was 62 cm^{-3} during hour 11 UT of August 3. The peak solar wind speeds are generally much reduced at Pioneer 10 compared with those observed at Pioneer 9. The peak 30-min average magnetic field magnitude was 85 γ during 1245-1315 UT of August 3. The Pioneer 9 data indicate passage of four fast forward interplanetary shocks, and one slow forward interplanetary shock. (auth)

PHYSICS (ATMOSPHERIC)

Auroral and Ionospheric Phenomena

Refer also to abstract 11407.

12460 (AD-779091) RAY TRACING STUDY. Final Report, 10 August 1967–31 May 1970. Hochman, E. H. (Electronic Associates, Inc., West Long Branch, N. J. (USA)). 15 Feb 1971. 72p. NTIS $6.75.

The report describes the application of hybrid computer techniques to the simulation of the propagation of electromagnetic energy in the ionosphere. A two dimensional electron density profile is incorporated. (auth)

12461 MAPPING OF foF2 BY MEANS OF TOPSIDE SOUNDER SATELLITES. Burge, J. D.; King, J. W.; Slater, A. J. (Science Research Council, Slough, Eng.). Telecommun. J.; 40: 356-363(Jul 1973).

"Maps" of f_0F2 have been produced from data obtained by means of the tape recorders on the Isis-1 and Isis-2 satellites at equatorial, middle, and polar latitudes. The plots show variations of f_0F2 over the Earth at constant local times and not at particular instants of UT. Many of the maps have been compared with the corresponding CCIR-predicted maps in order to assess the accuracy of the predictions. At low latitudes the positions of the trough and crests associated with the equatorial anomaly are reasonably accurately predicted, but the observed latitudinal gradients of f_0F2 are generally substantially greater than expected. Localized enhancements of f_0F2, in which the critical frequencies are about 3 MHz greater than the predicted values, occur over areas having radii of about 1000 km. These enhancements are noticed at locations where the predicted maps indicate the existence of an f_0F2 "high." Middle-latitude data have shown that the predicted nighttime maps of the South Pacific region are not as reliable as for other regions. At higher latitudes, 60 and 70 S, the observed longitudinal gradients of f_0F2 are usually about twice those predicted. Very steep gradients of f_0F2 are observed in the south polar region. (auth)

12462 MEASUREMENT OF THE EXTINCTION OF SOLAR HYDROGEN LYMAN-α RADIATION IN THE SUMMER ARCTIC MESOSPHERE. Thrane, E. V.; Johannessen, A. (Univ. of Tromsoe, Norway). J. Atmos. Terrest. Phys.; 37: No. 4, 655-661(Apr 1975).

Rocket observations of the extinction of solar hydrogen Lyman-α radiation have been used to derive pressure, density, and temperature in the mesosphere. Comparison of the derived atmospheric parameters with the standard atmosphere, with stratospheric data and with collision frequency measurements, lead to the conclusion that the laboratory measurements of the absorption cross section of Lyman-α in molecular oxygen do not apply to conditions in the upper atmosphere. (auth)

12463 STORM-TIME INCREASES IN THE IONOSPHERIC TOTAL ELECTRON CONTENT. Moffett, R. J.; Murphy, J. A.; Bailey, G. J. (Univ. of Sheffield, Eng.). Nature (London); 253: No. 5490, 330-331(31 Jan 1975).

It is stated that changes in the total electron content of the mid-latitude ionosphere during the first day of a number of geomagnetic storms have been observed, and that during the positive phase of the storms the magnitude of the increase in total electron content shows a pronounced maximum near sunset. These findings are discussed and explanations are sought. The results support the idea that an influx of ionisation from the protonosphere may be partly responsible for some storm-time increases of ionosphere electron content. (UK)

12464 IONOSPHERIC SOLAR FLARE EFFECT OBSERVATIONS. Bain, W. C.; Hammond, E. (Appleton Lab., Slough, Eng.). J. Atmos. Terrest. Phys.; 37: No. 3, 573-574(Mar 1975).

The vlf sudden phase anomaly measured near vertical incidence is shown to be the most efficient measure of flare effects. Its relation to solar x-ray bursts is also described. (auth)

12465 WHAT DO WE KNOW TODAY ABOUT THE AURORAE: NATURE'S MOST MAGNIFICENT SHOW. Egeland, A. Oslo; Universitetsforlaget. 61p. (In Norwegian).

The text of the 10th Fridtjof Nansen Memorial Lecture, 10 Oct 1973. (NO)

12466 CONTINUITY OF THE AURORAL OVAL IN THE AFTERNOON SECTOR. Snyder, A. L.; Akasofu, S. I.; Kimball, D. S. (Air Weather Service, Offutt AFB, NE). Planet. Space Sci.; 23: No. 1, 225-227(Jan 1975).

United States Air Force DMSP satellite auroral images and South Pole auroral all-sky camera data are presented to provide new direct evidence that the afternoon sector auroras lie within a continuous oval belt. An example is also presented to illustrate that afternoon substorm auroras occur within the auroral oval configuration. (auth)

12467 NONCONVECTIVE ION CYCLOTRON INSTABILITY. Wandzura, S.; Coroniti, F. V. (Univ. of California, Los Angeles). Planet. Space Sci.; 23: No. 1, 123-131(Jan 1975).

The electromagnetic ion cyclotron instability is shown to be nonconvective for a wide range of plasma β's and ring current proton anisotropies A. The addition of cold plasma to the ring current enlarges the region of the β-A parameter space for nonconvective instability. Thus, despite the high Alfvén speed outside the plasmasphere, ion cyclotron wave amplitudes could grow to appreciable levels and contribute to the pitch-angle and energy diffusion of ring current protons. (auth)

12468 TROPICAL F-REGION NIGHTGLOW ENHANCEMENTS IN THE BRAZILIAN SECTOR. Sahai, Y.; Teixeira, N. R.; Angreji, P. D.; Bittencourt, J. A.; Takahashi, H. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Ann. Geophys.; 30: No. 3, 397-403(Jul 1974).

Measurements of OI 7774 A and 6300 A tropical nightglow emissions were made with a grille spectrometer and a tilting-filter photometer, respectively, during March–September, 1972 at Mt. Agulhas Negras, Brazil. The temporal and spatial enhancements observed are studied in terms of F-region electron density and height changes, sometimes associated with enhanced magnetic activity. The observed time variations of the OI 6300 A emission intensities are compared with model calculations using electron density profiles obtained from an ionosonde operating at Sao Jose dos Campos. There is a good agreement between the calculated and observed intensities, with the major contribution coming from dissociative recombination process. (FR)

12469 STUDY OF EQUATORIAL SPREAD-F IRREGULARITIES USING FARADAY ANGLE SCINTILLATIONS. Kaushika, N. D.; de Mendonca, F. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Ann. Geophys.; 30: No. 3, 405-409 (Jul 1974).

The scintillations in Faraday angle of VHF signals from ATS-3 received at Sao Jose dos Campos (Mag. dip-23.7°) are caused by the irregularities of equatorial spread-F belt. The occurrence, and other characteristics of these scintillations are examined, and it is found that scintillations occur only in presence of large long period disturbances. It is argued that a possible means of triggering the generation of equatorial spread-F irregularities could be the spatial resonance between atmospheric gravity waves and the ionospheric plasma drifts in the equatorial zone. (FR)

12470 F-REGION MANIFESTATION OF ATMOSPHERIC GRAVITY WAVES AT LOW MID AND HIGH DIP-LATITUDES. Nagpal, O. P.; Gupta, B. (Delhi Univ. (India). Dept. of Physics and Astrophysics). Ann. Geophys.; 30: No. 3, 411-419(Jul 1974).

Short-term variations of f_0F_2 observed at Delhi (magnetic dip 42.4 deg) were subjected to spectral analysis, covering periods from 5 to 100 minutes. The analysis revealed a marked dip in the spectrum around 33 min period, which is attributed to interaction between the neutral air and ionization, and which depends on the direction of travel of the wave and on the magnetic dip angle. This study was extended to eight more stations to cover the (a) low dip-latitudes, (b) mid dip-latitudes, and (c) high dip-latitudes. With the exception of Huancayo, a near equatorial station, a marked dip in each spectra was observed, the period of which depended strongly on the magnetic dip angle. This is consistent with the gravity wave theory. It is concluded that the dips in the spectra of f_0F_2 fluctuations are a result of the gravity wave manifestation in an anisotropic ionosphere. (FR)

12471 DETAILED ANALYSIS OF ENERGY EXCHANGES AND POLARIZATION OF THE LINES COMPOSING PC 1 FINE STRUCTURE. Gokhberg, M. V.; Pokhotelov, O. A. (AN SSSR, Moscow. Inst. Fiziki Zemli); Perraut, S.; Villedary, C. de; Wehrlin, N. (Centre National d'Etudes des Telecommunications (CNET), 92-Issy-les-Moulineaux (France)). Ann. Geophys.; 30: No. 2, 309-318(Mar 1974). (In French).

Pcl micropulsations recorder at conjugate points were spectral analyzed by two different methods, one analog and the other numerical. It is shown that there is a periodic exchange of energy among the rays which form the Pcl emissions. The time lapse

during which this exchange takes place is related to the frequency separation of the rays. The time and spatial behavior of the polarization of these rays has also been studied. (FR)

12472 RESONANT PERIODS OF FIELD LINES IN THE GUIDED MODE, FOR A SIMPLE MAGNETOSPHERIC MODEL. Six, M. (Paris-6 Univ., 75 (France). Inst. de Physique du Globe). Compt. Rend., Ser. A, B; 280: No. 1, 21-24(6 Jan 1975). (In French).

A magnetospheric model, axi-symmetric around the dipole, is studied in a frequency range low enough as to render gyroresonance effects negligible. Equations of the electromagnetic field are then separable in two groups, one of them describing a field completely guided along the static lines of force. The radial electric component of this field depends on a differential equation of the second order. Its solutions are explicit in the simple case of a density distribution following an inverse radial cubic law. Resonances of this magnetosphere, supposedly bounded by a perfectly conducting earth, are computed. (auth)

12473 NIGHT-TIME AURORA AND ITS RELATION TO THE MAGNETOSPHERE. Feldstein, Ya I. (IZMIRAN, Moscow (USSR)). Ann. Geophys.; 30: No. 2, 259-272(Mar 1974).

From 2nd general scientific assembly of the International Association of Geomagnetism and Aeronomy; Kyoto, Japan (9 Sep 1973).

Studies of the global distribution of auroras yield helpful information on the large-scale magnetospheric structure and dynamics under disturbed conditions, and on the auroral particle source locations in the magnetosphere. The magnetosphere is formed due to solar plasma flux interaction with the geomagnetic field, and the various factors of this interaction affect the character and distribution of luminosity in high latitudes to which the remote magnetospheric regions are magnetically projected. (auth)

12474 AURORAL EXCITATION AND TIME VARIATION. Gerard, J. C. (Liege Univ. (Belgium). Inst. d'Astrophysique); Harang, O. E. (Tromsoe Univ. (Norway)). Ann. Geophys.; 30: No. 2, 273-283(Mar 1974).

From 2nd general scientific assembly of the International Association of Geomagnetism and Aeronomy; Kyoto, Japan (9 Sep 1973).

Recent progress in theories and observations of excitation processes of electron aurora is reviewed. At the last I. A. G. A. meeting of 1971 a similar report was given by Shepherd (1972). After summarizing some characteristic features of auroral electrons, the atmosphere's response to electron precipitation will be described. The atmosphere will react with the primary energy spectrum, deform it, and secondary electrons will be produced locally. This combined primary and secondary electron beam will excite and ionize the atmosphere giving rise to an emission and ionization profile which mainly depends on the primary flux. Recent work in the primary/secondary electron spectra is described, and important gaps in the understanding of this problem are pointed out. The ions and the metastables react with the atmosphere through secondary processes by a complex set of chemical and recombination processes. Some recent results are summarized. As secondary processes involve different reaction rates, the various processes will have different time constants. Some knowledge of these reaction coefficients can be learned by observing atmospheric response to fluctuating aurora. (auth)

12475 ROCKET AND SATELLITE OBSERVATIONS OF ENERGETIC PARTICLE PRECIPITATION IN RELATION TO OPTICAL AURORA. Hultqvist, B. (Kungliga Vetenskapsakademien, Kiruna (Sweden). Geofysiska Observatoriet; National Oceanic and Atmospheric Administration, Boulder, Colo. (USA). Environmental Research Labs.). Ann. Geophys.; 30: No. 2, 223-257(Mar 1974).

From 2nd general scientific assembly of the International Association of Geomagnetism and Aeronomy; Kyoto, Japan (9 Sep 1973).

The following matters are reviewed: relations between invariant latitude-time distributions of visible aurora and keV electron precipitation, the polar cap electron aurora, relations of the auroral oval to spacecraft measurements of energetic electrons, diffuse and discrete auroras, the average keV proton distribution in invariant latitude and time in relation to observations of hydrogen aurora, the observed large-scale coincidence of regions with proton and electron excited aurora, some characteristics of the keV proton distribution function in the upper ionosphere, the magnetic time dependence of the keV proton population in the upper ionosphere, relations between variations in keV proton and electron distributions, and some substorm effects. On the basis of the observational evidence presented a number of relevant physical processes are discussed, and this discussion is summarized in the form of a rough model of the behavior of the keV proton and electron populations in the magnetosphere. (auth)

12476 GROUND-BASED PHOTOMETRIC OBSERVATIONS OF THE TYPE A AURORA OF 17-18 DECEMBER 1971. Gerard, J. C. (Leige Univ. (Belgium). Inst. d'Astrophysique). Ann. Geophys.; 30: No. 3, 387-396(Jul 1974).

Ground-based observations have been made during the event of 17-18 Dec. 1971 from northern Norway, using a tilting-filter photometer monitoring intensities of N_2^+1.Neg., H_β, lambda 6300 OI and lambda 5200 NI. The high lambda 6300/N_2^+1.Neg. ratio classes this event among type A auroras. The lambda 6300/lambda 5200 ratio varies during the night and remains higher than the usual value of nearly 20. These observations are compatible with a soft electron flux (≈500 eV) as the origin of the red line enhancement as illustrated by comparison with a model aurora. It is also found that $N(^2D^0)$ is deactivated by collisions with electrons at a rate foreseen by thoretical calculations. An upper limit of about 40 seconds is derived for the $N(^2D^0)$ effective lifetime, though no simple relationship gives a good fit to the observations. (auth)

12477 "IN SITU" MEASUREMENTS WITH AUREOLE SATELLITE OF AURORAL PROTONS DURING PERIODS OF LOW MAGNETIC ACTIVITY. Crasnier, J.; Sauvaud, J. A. (Toulouse-3 Univ., 31 (France). Centre d'Etude Spatiale des Rayonnements); Galperin, Yu. I.; Kovrazhkin, R. A.; Ponomarev, Yu. N. (Institut de Recherches Spatiales de l'Academie des Sciences de l'URSS, Moscou). Ann. Geophys.; 30: No. 3, 357-367(Jul 1974). (In French).

Protons with energies between 0.4 and 30 keV precipitate regularly during periods of low magnetic activity at invariant latitudes above 68 deg. This precipitation region is located in the auroral region defined by ground-based measurements of Balmer series lines. The average energy of these particles, which are responsible for proton aurorae, reaches 10-15 keV. The stability and regularity of the precipitation suggest that it is due to a process connected with magnetospheric convection. The angular distributions have variable characteristics ranging from a nearly trapped distribution to an aligned distribution. Furthermore, similar precipitations have been found on the day time side of the magnetosphere in a zone adjacent to the polar cusp (region of direct particle access into the magnetosheath up to the ionosphere) and located at slightly lower latitudes. (FR)

12478 COVARIATION OF 6300 A AND 5577 A1 EMISSIONS IN TROPICAL NIGHT AIRGLOW AND THE EMISSION OF 5577 A FROM THE F-REGION. Ramachandra Rao, V.; Kulkarni, P. V. (Physical Research Lab., Ahmedabad (India)). Ann. Geophys.; 30: No. 2, 291-300(Mar 1974).

Night airglow observations of 6300 A [01] and 5577 A [01] have been taken at Mt. Abu (24.6 deg N, 72.7 deg E geographic, 34 deg dip, 1219 m above mean sea level) since 1964. A close examination of the observations taken in poleward direction (65 deg zenith angle) of all the moonless, cloudless nights showed that in the winter months on a number of occasions both red and green lines showed a covariation. The observations on the same emissions made with an all-sky scanning photometer at different zenith angles (75 deg, 70 deg, 60 deg, 40 deg and zenith) showed that, in general, there were more occasions of peak-to-peak covariation between 6300 A and 5577 A in southern latitudes of Mt. Abu than in its northern latitudes. A detailed study of ionospheric parameters and the electron density profiles from Ahmedabad (40 deg S zenith angle of Mt. Abu) showed that a Barbier-type relation can fit as well for the 5577 A observations during the occasions of high correlation; this result indicates that on such occasions major 5577 A contribution was from the F region of the ionosphere. The constant term in Barbier's formula gives the contribution to 5577 A from reactions other than dissociative recombination. (FR)

12479 SEASONAL AND UNDECENNIAL VARIATIONS OF CONTINUUM AIRGLOW EMITTED BETWEEN 4600 AND 5300 A IN THE HIGH ATMOSPHERE. Robley, R. (Observatoires du Pic du Midi et de Toulouse, Centre de Toulouse, 31 (France)). Ann. Geophys.; 30: No. 2, 339-345(Mar 1974). (In French).

A new process for eliminating the extra-terrestrial light enables one to show that the continuum airglow is maximal twice a year near the solstices and the continuum airglow seems well enough correlated with the Wolf number. The light emitted from the Milky Way and scattered by the terrestrial atmosphere is unable to explain the yearly changes. The airglow continuum might be modulated by the part of the cosmic-ray flux limited at the mean-energy range. (FR)

12480 EARTH'S DYNAMIC THERMOSPHERE. Hanson, W. B. (Univ. of Texas, Dallas). Astronaut. Aeronaut.; 13: No. 1, 16-22 (Jan 1975).

The kinetics of the earth's thermosphere is discussed including

solar ultraviolet radiation absorption, gravitational field effects, chemical composition, transport, the role of hydrogen, plasma kinetics, Spread F, the nighttime equatorial region, auroral heating, and the NSA rocket program. (JFP)

12481 QUESTIONS RELATED TO THE INVESTIGATION OF ANOMALOUS IONIZATION IN THE UPPER ATMOSPHERE. Khocholava, G. M.; Gachechiladze, R. G.; Mebagishvili, N. N. (Inst. of Geophysics, Tbilisi, USSR). Soobshch. Akad. Nauk Gruz. SSR; 77: No. RR, 589-592(Mar 1975). (In Russian).

Regularities of the spatial-temporal distribution of the anomalously heightened ionization in the nocturnal F-region, some questions of *f*oF 2 seasonal variations and their relation to the level of geomagnetic activity at middle latitude were investigated. (auth)

12482 SEASONAL VARIATIONS OF ELECTRON DENSITIES BELOW 100 km AT MID-LATITUDES. V. Radiation Temperatures and Electron Densities. Gregory, J. B.; Manson, A. H. (Saskatchewan Univ., Saskatoon, Can.). J. Atmos. Terrest. Phys.; 37: No. 4, 645-653(Apr 1975).

Maps of southern hemisphere radiation temperatures, for the 15 to 35 km altitude range, show the passage of warm centers in winter. For the year 1963 to 1964, the movements of these centers are compared with previous observations of the passage of travelling waves in the circulation above Australia and New Zealand. The associations of mesospheric electron densities with stratospheric temperature changes at 44°S, previously noted, are confirmed. The absence of such associations between ≃ 30°S and the equator is also demonstrated. (auth)

12483 ION COMPOSITION IRREGULARITIES AND IONOSPHERE–PLASMASPHERE COUPLING. Taylor, H. A. Jr.; Grebowsky, J. M.; Chen, A. J. (National Aeronautics and Space Administration, Greenbelt, MD). J. Atmos. Terrest. Phys.; 37: No. 4, 613-623(Apr 1975).

Atomic and molecular ion composition results from the polar orbiting OGO-4 and 6 satellites identify a high latitude trough (HLT) in the topside ionosphere (600 to 1000 km), as a repeatable signature, separate from the light ion trough (LIT) in H^+ and He^+, associated with the plasmapause. The HLT is often seen as a narrow (5 to 10° latitude) depletion of a factor of 3 or more in the concentrations of the atomic ions H^+, O^+, N^+ and He^+, accompanied by similarly abrupt enhancements in the concentrations of the molecular ions NO^+, N_2^+ and O_2^+. The coexistence of the HLT and the molecular ion peaks near 70° magnetic latitude suggests that the HLT may be associated with soft electron precipitation in the auroral zone/cusp region. This assumption is tentatively supported by the observation that low frequency hiss enhancements are observed simultaneously with the HLT. The presence of the HLT in addition to the LIT and its associated "plasmatail" structure presents an added complication for identifying ionospheric signatures of ionosphere-plasmasphere coupling, illustrating the need for studies of energetic as well as plasma convention mechanisms involved in the coupling processes. (auth)

12484 DYNAMICS OF DAY AND NIGHT AURORA DURING SUBSTORMS. Vorobjev, V. G.; Gustafsson, G.; Starkov, G. V.; Feldstein, Y. I.; Shevnina, N. F. (Polar Geophysical Inst., Apatity, USSR). Planet. Space Sci.; 23: No. 2, 269-278(Feb 1975).

The motion of auroral forms on the day- and nightside of the earth was studied during different substorm phases by means of all-sky camera films. A substorm is characterized by a shift of the luminescence region towards the equator at noon and mainly towards the pole at midnight. However, individual forms drift predominantly toward the pole on the dayside and towards the equator on the nightside. The velocity of the poleward motion at noon is largest during the expansive phase of a substorm and amounts on the average to 330 m/sec, but even during relatively quiet magnetic conditions a poleward motion is observed. (auth)

12485 MEASUREMENTS OF IONOSPHERIC REFRACTION AT 80 MHz USING DISCRETE RADIO SOURCES. Slee, O. B.; Lee, P. Y. (CSIRO, Epping, Australia). Aust. J. Phys.; 27: No. 6, 837-853(Dec 1974).

About 2000 measurements of source positions obtained at 80 MHz with the Culgoora radioheliograph near the peak of the solar activity cycle in 1968–71 have been used to determine the regular ionospheric refraction. Diurnal, seasonal, and zenith-angle dependencies of the refraction are deduced and found to be qualitatively consistent with the known gradients in peak electron density. The variability of the refraction from one measurement to the next is found to depend upon the zenith angle and season and to be mainly due to ionospheric disturbances whose presence is not usually revealed by measurements of the F_2 critical frequency. A quantitative comparison of the measured values of angular refraction with the F_2 critical frequency and its north–south and east–west gradients demonstrates the validity of the theoretical expressions for regular refraction developed by Komesaroff (1960) and yields a value of 190 ± 12 km for the equivalent thickness of the nocturnal ionosphere. A comparison of the present measurement of the thickness parameter with measurements of the same quantity made during the minimum of solar activity shows that the shape of the F_2 layer is not dependent on the solar activity cycle and hence is not a sensitive measure of the gas temperature. (auth)

12486 MEASUREMENT OF THE HEIGHT OF THE GREEN LINE 5577 A EMITTING LAYER OF THE NIGHT AIR-GLOW AT DUMKA (LAT: 24°16′N, LONG 87°15′E). Singh, J.; Chatterjee, S. D. (Indian Association for the Cultivation of Science, Calcutta). Indian J. Theor. Phys.; 22: No. 4, 97-102(Dec 1974).

Utilizing Van Rhijn's method of formulation, the height of the green line λ 5577 Å emitting layer of the night air-glow was experimentally determined at Dumka (lat: 24°16′N; long: 87°15′E). The measured height of 174 km. may be taken as the optical center or the center of gravity of two emitting layers, one located near 100 km. and the other near 250 km. (auth)

12487 CHANGES IN THE IONOSPHERIC PROFILE AND THE FARADAY FACTOR WITH M (OVERSCORED) WITH Kp. Papagiannis, M. D.; Hajeb-Hosseinieh, H.; Mendillo, M. (Boston Univ.). Planet. Space Sci.; 23: No. 1, 107-113(Jan 1975).

Using incoherent scatter data from Millstone Hill, Massachusetts, the variations in the shape of the daytime, mid-latitude ionospheric electron density profile associated with changes in geomagnetic activity have been investigated. The analysis performed was to deduce the dependence upon the 3-hr geomagnetic index Kp of $h(N_m)$, $h(0.7\ N_m)$ above and below N_m, the plasma scale height H_T in the range 500 to 1000 km, and the ratio $N(1000)/N(h_m)$. The electron density data used spanned the solar maximum years 1968 to 1971. Daytime data from the period 1000 to 1600 LT were averaged separately for summer, winter and spring-fall. It is shown that the mean value $\bar{M}$ of the factor $M = B \cos\theta \sec\chi$ used by Titheridge (Planet. Space Sci.; 20: 353 (1972)) to relate the Faraday rotation Ω from a geostationery satellite to the total electron content N_T up to 2000 km is practically the same (to within 1 to 2 %) as the $\bar{M}$ value used to relate the N_T and the Ω values both computed up to 1000 km. Taking advantage of this identity, the linear relationship obtained between the ionospheric parameters and Kp has been used to deduce the height at which $\bar{M}$ should be evaluated as a function of Kp. (auth)

12488 PHOTOIONIZATION OF BARIUM CLOUDS VIA THE ^3D METASTABLE LEVELS. Carlsten, J. L. (Harvard Univ., Cambridge, MA). Planet. Space Sci.; 23: No. 1, 53-60(Jan 1975).

The photoionization of optically thin barium clouds is analyzed and shown to occur primarily by a two-step process involving the ^3D metastable term as the intermediate state. The equilibrium populations of the ^1D and ^3D metastable levels are calculated and found to differ significantly from the values now in the literature. These populations are combined with newly available photoionization data to calculate the resulting photoionization rate in the upper atmosphere. (auth)

12489 EFFECT OF Sq DRIFT ON THE PHASE PATH OF E REGION REFLECTIONS. Bhar, J. N.; Purkait, N. N.; Datta, S. K. (Inst. of Radio Physics and Electronics, Calcutta). Indian J. Phys.; 48: No. 12, 1117-1123(Dec 1974).

The phase path (P) of an exploring wave of frequency 2·2 MHz reflected from the E region was studied at Haringhata (near Calcutta) experimentally for the period June to December 1971. The diurnal variation of P is compared with the diurnal variation of the height of reflection (h) of the exploring frequency, calculated for a Chapman layer satisfying quasi-equilibrium condition. It is found that the hourly deviation of P from 2h can be explained qualitatively on the basis of electromagnetic drift of the overhead Sq-current. (auth)

Magnetospheric Phenomena

Refer also to abstracts 12368, 12373, 12402, and 12403.

12490 NEUTRAL SHEETS. Dungey, J. W. (Imperial Coll. of Science and Technology, London (UK). Dept. of Physics). Space Sci. Rev.; 17: No. 2-4, 173-180(Mar 1975).

From international solar-terrestrial physics symposium; Sao Paulo, Brazil (17 Jun 1974).

With the growth of recognition of the importance of neutral sheets, the complexity of the subject has become apparent. Although the crucial problem concerns the vicinity of a neutral line, where the normal component B_z may be neglected, only a small fraction of satellite crossings can be expected in such a small region. The breakdown of the problem will be discussed and possible trajectories described for particles entering from either the lobes

or the magnetosheath. In each region a self-consistent problem must be solved for the electrostatic field and it is noted that this can drive field aligned currents to the ionosphere. High frequency instabilities will also be discussed and seem capable of causing the explosive onset of substorms. (auth)

12491 STUDY OF MAGNETOSPHERIC DYNAMICS USING ENERGETIC SOLAR PARTICLES. Morfill, G. (Max-Planck-Institut fuer Physik und Astrophysik, Garching; Muenchen (F. R. Germany). Inst. fuer Extraterrestrische Physik). Space Sci. Rev.; 17: No. 2-4, 391-433(Mar 1975).

From international solar-terrestrial physics symposium; Sao Paulo, Brazil (17 Jun 1974). 86 refs.

Information can be obtained from energetic particle measurements through the chemical composition, energy spectrum directional anisotropy, temporal and spatial intensity variations. This is equivalent to saying that there is a distribution function $f_k(p,r,t)$ where k corresponds to the kth particle species of momentum p at position r and time t. Particle transport is described by the Boltzmann equation, and because the densities are generally low in the case of cosmic rays or energetic solar-flare particles, collective transport effects can be neglected. In the absence of magnetospheric motion it is relatively easy to treat the problems of particle transport as simple propagation of charged particles in a stationary magnetic field configuration using, for instance, trajectory calculations in model fields. The method here is to use correlated measurements of the particle distribution at two points along a dynamic trajectory, and in this way to learn something about the geomagnetic field. This approach provides a good basis from which to study magnetospheric dynamics. If the magnetosphere moves, large scale electric fields, turbulent electromagnetic fields and sources and sinks affect the propagation of energetic particles considerably. These effects change the distribution function $f_k(p,r,t)$ and can thus be detected. In this paper, the importance of the single particle approximation (trajectories in a reference field) in forming the basis of the understanding of the quiet-time penetration of cosmic rays into the magnetosphere shall be shown, the "steady dynamics" such as wave-particle interaction and field line reconnection, which is believed to exist nearly all the time, shall be considered, and finally the work which has been done in the much more complex and less well-understood field of "impulsive dynamics" such as geomagnetic storms and substorms shall be reviewed. This last topic is only just beginning to be investigated in detail, and it is hoped that the study of "impulsive dynamics," using energetic particles, may be as successful as the study of the quiet magnetosphere and the "steady dynamics." (auth)

12492 WAVE-PARTICLE INTERACTIONS AND THEIR RELEVANCE TO SUBSTORMS. Fredricks, R. W. (TRW Systems Group, Redondo Beach, Calif. (USA)). Space Sci. Rev.; 17: No. 2-4, 449-480(Mar 1975).

From international solar-terrestrial physics symposium; Sao Paulo, Brazil (17 Jun 1974). 78 refs.

Wave–particle effects are implicit in most models of radial diffusion and energization of Van Allen belt particles; they were explicitly used in the wave turbulence model for trapped particle precipitation and trapped flux limitations by Kennel and Petschek, Cornwall, and by many others. Liemohn used wave–particle interactions to work out a theory of path-integrated whistler amplification process to explain the lack of large per-hop attenuation of multiple-hop If whistlers. Others have now used wave–particle interactions to construct theories of elf and vlf chorus. In the present paper the observations and some of the pertinent theoretical interpretations of wave–particle effects as they relate to substorm and storm-time phenomena will be reviewed. If substorms develop as a result of magnetic merging, then it seems clear that wave–particle interactions in the dissipative or so-called diffusion region of the reconnection zone may be of great importance. The plasma sheet thinning and flow towards the Earth lead inevitably to the development of particle distribution functions that contain free energy in a pitch-angle anisotropy. Such free energy can be released via plasma wave instabilities. The subsequent wave–particle interactions can result in both strong and weak diffusion of particles into loss cones with consequent precipitation fluxes into the auroral zone. Ring current proton spectra also should be unstable against various plasma instabilities with consequent ring current decay and precipitations. Wave–particle interactions must play some important roles in auroral arcs, electrojets, and other phenomena related to substorms. These aspects of wave–particle interactions will be covered. (auth)

12493 GEOMAGNETICALLY TRAPPED RADIATION. Schulz M. (Aerospace Corp., El Segundo, Calif. (USA). Space Physics Lab.). Space Sci. Rev.; 17: No. 2-4, 481-536(Mar 1975).

From international solar-terrestrial physics symposium; Sao Paulo, Brazil (17 Jun 1974). 107 refs.

This review covers the major developments in radiation belt phenomenology of the past four years (1970–1973). This has been a period characterized by consolidation and refinement of ideas and measurements related to geomagnetically trapped particles. Significant progress has been made in understanding ion and electron pitch-angle distributions within the context of radial diffusion and pitch-angle diffusion, respectively. Comparison of alpha-particle and proton distributions has helped to clarify the relative strengths of known radial-diffusion mechanisms. Careful measurements have indicated the directional flux of cosmic-ray-albedo neutrons, which constitute (through beta decay) a major source of high-energy ($\gtrsim$ 20 MeV) inner-belt protons. Inclusion of radial-diffusion and geomagnetic-secular effects has brought the theory of the inner proton belt into reasonable agreement with observation. At very low L values ($L \lesssim 1.2$) atmospheric collisions have been found to facilitate the radial transport of 40 keV protons and 2 MeV electrons. The plasmapause has been identified as an important boundary for plasma instabilities (wave-particle interactions) that lead to particle precipitation and red-arc excitation. Suggestions have followed for artificially simulating such plasmaspheric effects by magnetospheric injection of cold barium or lithium plasma. (auth)

12494 IONOSPHERE-MAGNETOSPHERE COUPLING. Wolf, R. A. (Rice Univ., Houston, Tex. (USA). Dept. of Space Science). Space Sci. Rev.; 17: No. 2-4, 537-562(Mar 1975).

From international solar-terrestrial physics symposium; Sao Paulo, Brazil (17 Jun 1974). 91 refs.

The large-scale electrical coupling between the ionosphere and magnetosphere is reviewed, particularly with respect to behavior on time scales of hours or more. The following circuit elements are included: (1) the magnetopause boundary layer, which serves as the generator for the magnetospheric-convection circuit; (2) magnetic field lines, usually good conductors but sometimes subject to anomalous resistivity; (3) the ionosphere, which can conduct current across magnetic field lines; (4) the magnetospheric particle distributions, including tail current and partial-ring currents. Magnetic merging and a viscous interaction are considered as possible generating mechanism, but merging seems the most likely alternative. Several mechanisms have been proposed for causing large potential drops along magnetic field lines in the upper ionosphere, and many isolated measurements of parallel electric fields have been reported, but the global pattern and significance of these electric fields are unknown. Ionospheric conductivities are now thoroughly measured, but are highly variable. Simple self-consistent theoretical models of the magnetospheric-convection system imply that the magnetospheric particles should shield the inner magnetosphere and low-latitude ionosphere from most of the time-average convection electric field. (auth)

12495 OBSERVATIONS OF BIRKELAND CURRENTS. Cloutier, P. A.; Anderson, H. R. (Rice Univ., Houston, Tex. (USA). Dept. of Space Science). Space Sci. Rev.; 17: No. 2-4, 563-587(Mar 1975).

From international solar-terrestrial physics symposium; Sao Paulo, Brazil (17 Jun 1974).

Recent measurements of precipitating energetic particles and vector magnetic fields from satellites and sounding rockets have verified the existence of geomagnetically-aligned electric currents at high latitudes in the ionosphere and magnetosphere. The spatial and temporal configuration of such currents, now commonly called Birkeland currents, has delineated their role in providing ionospheric closure of magnetospheric current systems, and gross features of these current systems may be understood in terms of theoretical models of magnetospheric convection. The association of Birkeland currents with auroral features on a very small scale suggests that auroral acceleration may result from the current flow. (auth)

12496 PLASMA AND FIELDS IN THE MAGNETOSPHERIC TAIL. Schindler, K. (Bochum Univ. (F. R. Germany)). Space Sci. Rev.; 17: No. 2-4, 589-614(Mar 1975).

From international solar-terrestrial physics symposium; Sao Paulo, Brazil (17 Jun 1974). 70 refs.

Recent developments in the physics of the magnetospheric tail are reviewed. Particular emphasis is placed on progress in self-consistent theory and on the comparison of its results with the observations. It is demonstrated that several of the macroscopic properties of the tail can be understood in terms of a rather simple two-dimensional picture in which the plasma is static and isotropic. Certain stability properties of the tail can be related directly to simple geometric properties of the unperturbed static configuration. This discussion then leads over to the question to what extent present stability theory is able to explain the onset of the magnetospheric substorm. The review finishes with a brief description of the present state of the theory of steady state merging. (auth)

12497 THE EQUATORIAL SCINTILLATION BELT AS OBSERVED AT HUANCAYO, PERU. Chatterjee, S. K.; Bandyo-

padhyay, A. K.; Guhathakurta, B. K.; Bandyopadhyay, P. (Calcutta Univ. (India)). Ann. Geophys.; 30: No. 2, 329-337(Mar 1974).

The width of the equatorial scintillation belt was estimated at Huancayo, Peru using BE-B and BE-C data of high sunspot number years (1967-68). The estimated half occurrence widths (11 to 22 deg of magnetic latitude) are found to be considerably less than that (32 deg) observed at stations in Africa by similar technique. The narrower width is believed to be a zonal effect. Some zonal differences in scintillation and spread-F phenomena of the equatorial region are discussed in this connection. Histograms showing the sectional lengths of the irregularity clouds as seen by BE-B and BE-C passes are presented. It is found that the lengths vary within wide limits although short lengths are most frequent. (FR)

12498 MEASUREMENT OF LOW FREQUENCY MAGNETIC FLUCTUATIONS IN THE MAGNETOSPHERE. Parady, B. K. Minneapolis; Univ. of Minnesota (1974). 265p. University Microfilms Order No. 74-26,223.

Thesis (Ph. D.).

The observation of low frequency magnetic fluctuations in the magnetosphere is examined. An overview of magnetospheric physics and plasma wave theory is presented. The construction of the Siple micropulsation detector is detailed. It provides data from waves of periods of 1 to 1000 seconds with a maximum sensitivity of 0.2 m gamma. Some preliminary observations from this detector are presented showing instances of Pcl and Pil. A description of the Explorer 45 search experiment is presented and results from the experiment are discussed extensively. Results from the Explorer 45 search coil experiment describe the behavior of plasmaspheric hiss for the first nine months of operation. The intensity of hiss for the December 1971 storm is detailed and a statistical study is carried out. Results indicate that hiss becomes most intense during the recovery of the storm and moves inward. There is an association of hiss with proton events on orbits 99 and 101. The statistical study shows that hiss is more intense on the dayside than the nightside, for the dayside the location of hiss peaks bears some relation to D/sub st/ and the location of the hiss boundaries bears some relation to K/sub p/. Hiss peaks are found to be commonly 2 R/sub e/ inside the hiss boundaries. Anisotropic proton instability hiss (APIM) is presented as a generation mechanism for plasmaspheric hiss. APIM hiss predicts that: hiss will be generated in a band about the local lower hybrid resonance frequency. Wave growth is at large wave normal angles. Wave growth is related to a proton pitch angle anisotropy. Wave growth is related to peaked proton energy distributions. Wave growth is related to the density of interacting protons. Wave growth should be maximized at the equator. These predictions are found to be in agreement with both published results and results from the Explorer 45. (Diss. Abstr. Int., B)

12499 TRANSPORT OF ENERGETIC SOLAR PARTICLES ON CLOSED MAGNETOSPHERIC FIELD LINES. Scholer, M. (Max-Planck-Institut fuer Physik und Astrophysik, Garching; Muenchen (F. R. Germany). Inst. fuer Extraterrestrische Physik). Space Sci. Rev.; 17: No. 1, 3-44(Feb 1975).

Whereas the entry mechanism of energetic solar particles into the open field line region of the magnetosphere is now a rather well understood process, transport processes of solar particles in the closed field line region are still unclear and under dispute. The main difficulty lies not only in the fact that different field models predict different behavior of the particles in the quasi-trapping region (e.g., cut-off latitude), but that dynamic changes of the magnetosphere as geomagnetic storms and substorms greatly influence the particle distribution. The present review tries to summarize the status of knowledge regarding solar proton behavior on closed magnetospheric field lines. Together with a presentation of recent measurements in the closed field line region, relevant theoretical problems are discussed. They fall either under the study of single-particle motion in different static magnetospheric configurations (due to different field models or due to real, e.g., ring current-induced, changes) or under the study of resonant interaction processes as pitch angle scattering and radial diffusion. (auth)

PHYSICS (ATOMIC AND MOLECULAR)

Beams and Their Reactions

Refer also to abstracts 12552, 12890, 12895–12899, and 12903.

12500 COLLISIONAL DEPOLARIZATION OF EXCITED SODIUM ATOMS. Eibel, M.; Kamke, B.; Schneider, W. B. (Marburg Univ. (F. R. Germany). Fachbereich Physik). Physica; 77: No. 1, 137-147(1 Oct 1974).

Sodium vapour is excited by D_2 radiation. The linear polarization of the fluorescent D_2 radiation emitted at right angles to the incident-light beam is measured as a function of the pressure of an added noble gas. A magnetic field of 270 Oe which points parallel to the incident-light beam, serves to decouple the nuclear spin in the excited state. From the decrease of the polarization observed at rising pressure, cross sections for the disalignment of the electron in the excited state are derived. They are 167, 174, 308, 341, 376 $Å^2$ for the noble gases He, Ne, Ar, Kr, Xe at 383 K. These and earlier results on sodium depolarization are summarized and compared with theoretical results by Masnou et al., Reid, and Lewis et al. Satisfactory agreement is obtained. (auth)

12501 QUANTUM MECHANICAL STUDY OF ELECTRONIC TRANSITIONS IN COLLINEAR ATOM-DIATOM COLLISIONS. Zimmerman, I. H.; George, T. F. (Rochester Univ., N. Y. (USA). Dept. of Chemistry). Chem. Phys.; 7: No. 3, 323-335(Mar 1975).

Quantum mechanical calculations are reported for model, nonreactive, collinear collision systems composed of the H_2 diatom and the halogen atom X = F, Cl, Br or I. The model involves two electronic potential energy surfaces, obtained in a diatomics-in-molecules formulation, that correspond asymptotically to the two spin-orbit states of X. On each surface the calculations include as many vibrational states of H_2 as are asymptotically allowed, up to a limiting number of five. The first two collision systems, F-H_2 and Cl-H_2, are characterized by electronic splittings much smaller than any vibrational spacing included in the diatom spectrum, and as a result they show a high degree of vibrational elasticity with essentially all transition activity restricted to spin-orbit switching in the halogen. This pattern is broken for Br-H_2 collisions, where the near-equality between electronic and vibrational quanta apparently leads to a resonant exchange of energy between the two modes. The greater spin-orbit splitting in iodine (~2 vibrational quanta) results in largely elastic behavior in I-H_2 collisions for both vibrational and electronic transitions. A modified Massey criterion is exhibited for some of the F-H_2 and Br-H_2 transitions. (auth)

12502 CLASSICAL BINARY-ENCOUNTER CALCULATIONS OF IONIZATION BY HEAVY CHARGED PROJECTILES. Singhal, R. P.; Singh, V. (Banaras Hindu Univ. (India). Dept. of Physics). Physica; 78: No. 2, 343-345(1 Dec 1974).

Classical binary-encounter calculations have been performed for the K-shell ionization cross section of Al and Ni target atoms by $^1_1$H, $^4_2$He and $^7_3$Li projectiles. The binding-energy correction due to the interaction of the projectile with target K electrons has been incorporated along with the correction due to Coulomb repulsion. It is found that the simple BEA theory can account for the experimentally observed deviation of the cross section from a Z_1^2 dependence. (auth)

12503 CH_4-Ar POTENTIAL FROM BEAM SCATTERING. Brooks, J. R.; Grosser, A. E. (McGill Univ., Montreal, Quebec (Canada). Dept. of Chemistry). Physica; 78: No. 2, 340-342 (1 Dec 1974).

Lennard-Jones (n,6) potentials fitted to differential cross-section measurements for CH_4–Ar, in conjunction with those from bulk-property studies, confirm that the optimum value of the repulsive exponent n is 18-21. (auth)

12504 POLARIZATION FRACTIONS OF K X-RAYS EMITTED BY FAST FLUORINE IONS INCIDENT IN DIFFERENT CHARGE STATES ON HELIUM. Czuchlewski, S. J.; Ellsworth, L. D.; Guffey, J. A.; Horsdal Pedersen, E.; Salzborn, E.; MacDonald, J. R. (Kansas State Univ., Manhattan (USA). Dept. of Physics). Phys. Lett., A; 51: No. 5, 309-311(24 Mar 1975).

Polarization fractions have been measured for K X-rays emitted by energetic fluorine ions passing through helium gas. A strong monotonic charge state dependence is found increasing to an observed polarization of ~30% for highly charged ions. (auth)

12505 STUDIES OF THE ION SOURCE WITH SURFACE-VOLUME IONIZATION. Latuszynski, A.; Raiko, V. I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). Nucl. Instrum. Methods; 125: No. 1, 61-66(15 Mar 1975).

The ionization processes occurring in a closed volume of an ion source at high temperatures are considered. Expressions have been found for the ionization degree as a function of temperature and density of the ion current extracted from the volume. The results are presented of the experimental investigation of the suggested mechanism of the ion source. (auth)

12506 DEVELOPMENT OF A NEW METHOD FOR THE QUANTITATIVE ANALYSIS OF ENERGY LOSS SPECTRA OF FAST ELECTRONS SCATTERED IN THE DIRECTION OF THE INCIDENT BEAM: APPLICATION TO THE STUDY OF NOBLE METALS. Wehenkel, C. (Paris-6 Univ., 75 (France). Lab. de Chimie Physique). J. Phys. (Paris).; 36: No. 2, 199-213(Feb 1975). (In French).

In the energy loss spectra obtained around the forward direction, the single scattering volume and surface loss contributions are separated from the plural scattering contributions by iterative calculations. The complex dielectric constant, which is determined from the volume contribution after normalization and Kramers-Kronig analysis, is used to compute the usual optical functions (namely the photoabsorption coefficient and the plane wave oscillator strengths) over a large energy range (2 to 200 eV or more), the quality of the results remaining nearly constant throughout the entire range explored. The results obtained for the noble metals (Cu, Ag, Au) are compared with different optical measurements and are used to illustrate the capabilities of this method of analysis for elucidating the energy loss mechanism as well as for the study of the weakly bound electron. (auth)

12507 ENERGY SPECTRA OF SCATTERED PARTICLES IN PROTON BOMBARDMENT OF A METAL TARGET. Zhabrev, G. I.; Kurnaev, V. A.; Tel'kovskii, V. G. (Moscow Inst. of Engineering Physics). Sov. Phys.-Tech. Phys. (Engl. Transl.); 19: No. 7, 978-979(Jan 1975).

Translated from Zh. Tekh. Fiz.; 44: No. 7, 1560-1562(Jul 1974).

By measuring the fraction of neutrals in the scattered beam and the energy spectra of the ion components, the energy distributions of the total flux of reflected atomic particles can be obtained without dependence on charge. Spectra are found for bombardment of a Ni target at a glancing angle $\alpha = 15°$ by 20-keV protons. At a small scattering angle (20°) the spectral shape is in qualitative agreement with that calculated from multiple-scattering theory. At larger angles (55°) the spectral shape is characteristic of the single-scattering model. (auth)

12508 OPTICAL LINE AND BROAD-BAND EMISSION FROM ION-BOMBARDED TARGETS. Van Der Weg, W. F.; Lugujjo, E. (California Inst. of Technology, Pasadena). pp 511-522 of Atomic Collisions in Solids. Vol. 2. Datz, S. (ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

A variety of solid targets have been bombarded with 40-keV Ar^+ ions. The resulting optical emission was studied with a grating monochromator. The observed spectra consist mainly of lines from sputtered target particles. For several elements, a continuum was also present in the spectrum. When metals with filled or nearly filled d-shells were used as a target, the radiation intensity showed a transient behavior as a function of the time elapsed since the beam is switched on. A high initial intensity in these cases will be related to emission from a partly oxidized surface, since it has been observed before that an oxidized surface emits more light than a clean one, probably due to the absence of radiationless de-excitations near oxide surfaces. (4 figures, 16 references) (auth)

12509 REDUCTION OF THE CHARACTERISTIC RADIATION DUE TO THE CHANNELING EFFECT. Kalashnikov, N. P. (Moscow Physical-Engineering Inst.). pp 523-528 of Atomic Collisions in Solids. Vol. 2. Datz, S. (ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

The channeling effect essentially changes the electromagnetic processes in a single crystal when the angle between the momentum of incident fast nonrelativistic positive charged particle and crystallographic plane is smaller than the critical Lindhard channeling angle. The wave function of the channeling particles appears to be exponentially small near the atomic rows or the planes resulting in a substantial reduction of the probability of the processes characterized by small impact parameters. The excitation process of the K-electron by the fast positive ions in a

single crystal has been studied when the momentum of the incident particles is parallel to the crystallographic plane. (auth)

12510 SCATTERING OF LOW ENERGY H^+ AND He^+ IONS FROM A (001) COPPER SURFACE. Feijen, H. H. W.; Verhey, L. K.; Suurmeijer, E. P. T. M.; Boers, A. L. (Groningen State Univ., Netherlands). pp 573-581 of Atomic Collisions in Solids. Vol. 2. Datz, S. (ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

Energy spectra and angle dependent yield distributions of 3-9 keV H^+ and He^+ ions scattered from a (001) face of a copper single crystal were measured. Spectra recorded for scattering planes making small angles with a [110] direction on the surface are influenced by the focusing action of the surface semi-channels in this direction. Computer simulations were carried out to understand the main regularities of this focusing effect. (6 figures) (auth)

12511 INFLUENCE OF THERMAL LATTICE VIBRATIONS ON MULTIPLE ION SCATTERING. Verhey, L. K.; Boers, A. L. (Groningen State Univ., Netherlands). pp 583-594 of Atomic Collisions in Solids. Vol. 2. Datz, S. (ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

The influence of the target temperature on the multiple scattering of 6 keV Ar^+ ions on a (100)-face of a copper single crystal has been investigated. Scattered Ar^+ energy distributions have been measured as a function of the target temperature. Parameters in the experiment were the ion incidence angle (psi is less than 15^0) and the azimuthal angle of target rotation. Comparison of the experimentally observed temperature dependencies with computer simulations make it possible to estimate the influence of the thermal lattice vibrations on the ion scattering characteristics. (8 figures, 14 references) (auth)

12512 X-RAY PRODUCTION AND ENERGY LOSS IN LOW-ANGLE ION SCATTERING AT SOLID SURFACES. Farmery, B. W.; Harbinson, G. S.; Marwick, A. D.; Pabst, H.; Thompson, M. W. (Univ. of Sussex, Eng.). pp 595-598 of Atomic Collisions in Solids. Vol. 2. Datz, S. (ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

The production of x-rays from tungsten (M shell) and oxygen (K shell) by protons in the range 100 to 275 eV and the energy spectra of the scattered protons were studied using a target of amorphous tungsten oxide. The same measurements were made for the tungsten (M shell) x-rays by proton bombardment of a tungsten single crystal target. (GHT)

12513 SPUTTERING OF CONDENSED GASES BY PROTON BOMBARDMENT. Erents, S. K.; McCracken, G. M. (United Kingdom Atomic Energy Authority, Abingdon, Eng.). pp 625-634 of Atomic Collisions in Solids. Vol. 2. Datz, S. (ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

The desorption of heavy gases such as Ar, N_2 and CO by 5 keV protons was studied. It is a much less probable process than the desorption of the light gases such as hydrogen and helium. This is in general agreement with the very large difference in their heats of sublimation. From the present results helium appears to behave in a similar way to hydrogen with yields of approximately 10^4 atoms/ion and this can be explained qualitatively on the basis of the thermal spike mechanism previously developed for hydrogen. However, a detailed explanation is not yet possible because in the present experiments the helium is only adsorbed rather than condensed, and its thickness has not been well defined. (6 figures) (auth)

12514 ANGULAR DISTRIBUTION OF FAST CHARGED PARTICLES REFLECTED BY THE SURFACE OF A SINGLE CRYSTAL. Kalashnikov, N. P. (Moscow Physical-Engineering Inst.). pp 635-641 of Atomic Collisions in Solids. Vol. 2. Datz, S. (ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

Backscattered particles with energy (E/sub f/) close to the incident energy (E/sub i/) escape the monocrystal target from the thickness which is smaller or comparable with the inelastic scattering length. In the case of small energy losses E/sub i/-E/sub f//E/sub i/ much less than 1, the angular distribution of the backscattered particles corresponds to the usual Rutherford scattering if the incident and final directions of the particle momenta do not coincide with crystallographic axes. When the incident momentum direction and/or the backscattered momentum direction coincides with any crystallographic axis, the blocking effect essentially reduces the scattering of the fast charged particles. When the energy losses are not small enough, the differential backscattering coefficients of fast charged particles for a single crystal and for an amorphous medium coincide, provided that the incident and final directions are not parallel to crystallographic axes. In the opposite case the channeling effect for positive charged particles leads to the essential decrease of the differential backscattering coefficient. (auth)

12515 INELASTIC SCATTERING OF LOW-ENERGY ELECTRONS BY TIGHT-BINDING ELECTRONS. Ing. B. S.; Pendry, J. B. (Cambridge Univ., Eng.). J. Phys., C (London); 8: No. 8, 1087-1098(21 Apr 1975).

The absorption of elastic flux is calculated for electrons with energies in the range 0 to 20 Hartrees (0 to 500 eV), interacting with tightly bound bands in a crystal. The inelastic scattering is usually dominated by conduction and valence bands and varies with energy in a manner substantially independent of the band being excited, asymptotically as $E^{-\frac{1}{2}}$ ln E. In close-packed structures the strength of absorption varies only weakly over the unit cell, but for more open structures large variations can be expected from one part of the cell to another. The results are relevant to LEED and photoemission experiments. (auth)

12516 SPACE CHARGE RELATED ENERGY DEFICIT IN BEAMS FROM CHARGE EXCHANGE SOURCES. Aten, J. A.; Los, J. (Stichting voor Fundamental Onderzoek der Materie, Amsterdam). J. Phys., E (London); 8: No. 5, 408-410(May 1975).

When a beam of neutral alkali atoms is obtained by resonant charge exchange of accelerated ions, the energy of the neutral atoms can be appreciably smaller than the energy corresponding to the accelerating voltage. Energy deficits up to 20% were measured. The effect can be explained in terms of a space charge distribution. (auth)

12517 DOPPLER'S SHAPE OF THE SPECTRAL LINES EMITTED BY He^+, Ne^+, Ar^+ IONS SCATTERED ON THE Cu TARGET. Warczak, A.; Brozdowska-Warczak, B.; Pedrys, R.; Gabla, L. (Jagellonian Univ., Krakow). Acta Phys. Pol., Ser. A47: No. 4, 543-551(Apr 1975).

Calculation of the line shape of radiative transitions obtained by impact of He^+, Ne^+ and Ar^+ ions of 8 and 20 keV energy on Cu single crystal is made. The spectral lines emitted by scattered projectiles are shaped due to Doppler effect. The neutralization of scattered ions, deexcitation without photon emission, absorption of ions in the target material, and thermal vibrations of the target atoms are taken into account. All calculations give quantitative results. (auth)

Atomic and Molecular Properties

Refer also to abstract 11296.

12518 CALCULATION OF THE ROTATIONAL MAGNETIC MOMENT OF THE HYDROGEN MOLECULE. Kim, H.-W.; Hameka, H. F. (Pennsylvania Univ., Philadelphia (USA). Dept. of Chemistry). Chem. Phys. Lett.; 32: No. 2, 241-243(15 Apr 1975).

The rotational magnetic moment at equilibrium nuclear distance has been calculated for the hydrogen molecule by means of a variation-perturbation method. A value of 0.89471 nuclear magnetons is obtained, which should be compared with the experimental result of 0.88291 nuclear magnetons. (auth)

12519 THE ELECTRONIC SPECTRUM OF THE MOLECULES LaH AND LaD. Bacis, R.; Bernard, A.; Zgainsky, A. (Lyon-1 Univ., 69- Villeurbanne (France)). Compt. Rend., Ser. A, B; 280: No. 4, 77-78(27 Jan 1975). (In French).

The new electronic band systems of LaH, appearing between 5,300 and 6,500A, were excited using a hollow cathode discharge tube. Two similar systems in LaD were also observed. The rotational structure, the intensity distribution in the P, Q and R branches, and the Λ-doubling, show that these bands can be ascribed to ($^1\Sigma$, $^1\Delta \rightarrow {}^1\Pi$ and $^3\Phi \rightarrow {}^3\Delta$) transitions. (FR)

12520 FINE STRUCTURE MEASUREMENT IN $1s3p3\pi_u$ AND $1s4p^3\pi_u$ ELECTRONIC LEVELS IN THE HYDROGEN MOLECULE USING LEVEL CROSSING IN NON-ZERO FIELDS. Baltayan, P. (Grenoble-1 Univ., 38- Saint-Martin-d'Heres (France)).

pp 221-226 of Methods of Doppler Natural Linewidth Spectroscopy of Excited Levels in Simple Molecular Systems. Paris, France; Centre National de la Recherche Scientifique (1974). (In French).

From international colloquium on Doppler natural linewidth spectroscopy of excited levels in simple molecular systems; Aussois, France (23 May 1973).

The fine structure of the levels of parahydrogen have been measured by non-zero magnetic field level crossing. (auth)

12521 EXPERIMENTAL LOCALIZATION OF A SATELLITE LINE ON THE RED WING OF THE α LYMAN LINE BROADENED BY A PLASMA. Queffelec, J. L.; Girault, M. (Rennes-1 Univ., 35 (France)). Compt. Rend., Ser. A, B; 279: No. 26, 649-652 (23 Dec 1974). (In French).

A satellite of very low intensity was experimentally observed for the first time on the red wing of the Lyman α line of hydrogen broadened by a plasma. Located at Δlambda = 16.5A from the center of L(α), this satellite, due to the proton contribution to the line broadening, had been predicted in 1973 by Stewart, et al. theories at Δlambda = 17.83A and Le Quang Rang and Voslamber at Δlambda = 18.6A. (Fr)

12522 FIELD OF APPLICATION OF LOW ENERGY ACCELERATORS: THE BEAM-FOIL SPECTROSCOPY. Cesati, A.; Cristofori, F. (CISE, Milan). Energ. Nucl. (Milan).; 22: No. 4, 210-214(Apr 1975). (In Italian).

The technique of "beam-foil spectroscopy" (BFS) is briefly described, and its advantages with respect to the traditional atomic spectroscopy are shown. The main fields of application of this technique are also discussed, and namely: studies of lifetime of the atomic levels and measurements of fine and hyperfine structure, of the Stark and Zeeman effects and of the Lamb-shift. Some investigations in the field of fundamental physics, relevant to this technique, are then indicated, which could be performed with the use of the tandem Van de Graaff accelerator of CISE. (auth)

12523 DEUTERIUM QUADRUPOLE COUPLING IN THE GAS PHASE. Kukolich, S. G. (Univ. of Arizona, Tucson). Mol. Phys.; 29: No. 1, 249-255(Jan 1975).

Recent measurements of deuterium quadrupole coupling in the gas phase are reviewed. Most of the results presented were obtained using molecular beam maser spectrometers and this type of apparatus is discussed briefly. Variations in the quadrupole coupling strength for changes in the adjacent atom and bond order are discussed. The relation between electric field gradients and stretching force constants is examined in terms of the experimental data. (auth)

12524 Ab-INITIO VALENCE BOND CALCULATIONS ON THE He–He POTENTIAL CURVE USING SMALL BASES. Wormer, P. E. S.; Berkel, T. V.; Avoird, A. V. D. (Katholieke Univ., Nijemen, Netherlands). Mol. Phys.; 29: No. 4, 1181-1188(Apr 1975).

In studying methods for the ab-initio calculation of Van der Waals interactions which can be extended to larger molecules, the valence bond scheme on the He_2 system was tested. This method looks promising, as it appears to yield in one consistent formalism both the attractive dipole-dipole terms and the repulsive exchange terms with reasonable accuracy, using only a simple orbital basis and a very small number of VB structures. (auth)

12525 STARK BROADENING TABLES FOR He I λ 4922 A. Barnard, A. J.; Cooper, J.; Smith, E. W. (British Columbia Univ., Vancouver, Can.). J. Quant. Spectrosc. Radiat. Transfer.; 15: No. 6, 429-437(Jun 1975).

The Stark broadening of He I λ 4922 Å and its forbidden components by both ions and electrons is calculated using a theory that includes ion dynamic effects. Tables are presented for temperatures from 5000 to 40,000°K covering the density range 10^{13} to $10^{16}cm^{-3}$ for both helium and hydrogen ionic perturbers. (auth)

12526 HELIUM EMISSION SPECTRA. I. Intermediate Pressure Studies. Lott, D. E.; Glick, R. E.; Llewellyn, J. A. (Florida State Univ., Tallahassee). J. Quant. Spectrosc. Radiat. Transfer.; 15: No. 6, 513-526(Jun 1975).

The apparent cross sections of the $n^1P(n = 3,4,5,6)$ and $n^{1,3}D(n = 4,5,6,7)$ levels were measured as a function of pressure between 5 and 200 mTorr at 1.5 keV electron impact excitation energy. The 4^1S apparent cross section was measured under the same conditions to observe secondary electron effects. A detailed analysis is made on the mechanisms of excitation transfer out of the n^1P levels in terms of radiative and collision processes. Collisional $n^1P \rightarrow nF$ transfer cross sections are calculated for the n = 4 and n = 5 levels, and the results are in agreement with the principle of detailed balance. An analysis of the 6^1P apparent cross section indicates that collision processes other than $n^1P \rightarrow nF$ become important at n = 6 level in determining collisional transfer out of n^1P. Evaluation of $n^{1,3}D$ apparent cross sections show that direct collisional gain and loss become more important as n increases. (auth)

12527 VARIABLE DIMENSIONALITY IN THE GROUP-THEORETIC PREDICTION OF CONFIGURATION MIXINGS FOR DOUBLY-EXCITED HELIUM. Herrick, D. R. (Bell Labs., Murry Hill, NJ). J. Math. Phys. (N.Y.); 16: No. 5, 1047-1053(May 1975).

Variable dimensionality (equals D) is used to interpret recent group-theoretic predictions of configuration mixings in doubly-excited helium. Calculated $2s^2$:$2p^2$ ^1S mixings agree with the group theory over the range 1 less than or equal to D less than or equal to infinity. General results for D equals 2 predicted mixings are given, and energies of states within the N equals 2 atomic shell confirm predicted level orderings. The D equals 1 model atom is described exactly by the group theory, with quantum numbers and a selection rule characterizing the stability of Coulomb matrix elements as D yields 1. The exact D equals 1 results have a physical interpretation in approximate autoionization and energy selection rules for Rydberg series at D equals 3. (auth)

Positronium, Muonium, and Muonic and Mesic Atoms and Molecules

Refer also to abstracts 11958 and 12580.

12528 (ZFK-283, pp 53-55) ENERGY SHIFT OF ELECTRONIC X-RAYS FROM MUONIC URANIUM ATOMS. Arlt, R. (Technische Univ., Dresden); Gansorig, D.; Krogulski, T.; Ortlepp, H. G.; Polikanov, S. M.; Fromm, W. D.; Schmidt, U. Aug 1974. (In German).

In joint annual report, 1974.

12529 ELECTRON DEPLETION IN MESIC ATOMS. Condo, G. T. (Tennessee Univ., Knoxville (USA). Dept. of Physics). Phys. Lett., A; 51: No. 5, 307-308(24 Mar 1975).

Assuming there is no serious electron depletion in mesic atoms, most previously calculated Auger electron spectra for nuclear emulsion have ignored a large low energy (18-25 keV) contribution. A method for investigating electron depletion in mesic atoms is suggested. (auth)

12530 VACUUM POLARIZATION PHENOMENOLOGY: THE μ MESIC ATOM X-RAY DISCREPANCY AND THE 2P/SUB 3/2/– 2S/SUB 1/2/ SEPARATION IN THE $(\mu^4He)^+$ SYSTEM. Barbieri, R. (European Organization for Nuclear Research, Geneva (Switzerland)). Phys. Lett., B; 56: No. 3, 266-270(28 Apr 1975).

The possible existence of non-perturbative vacuum polarization modifications and the possible existence of a weakly-coupled light scalar boson have been recently proposed to explain the apparent μ-mesic atom X-ray discrepancy. Their effects are shown to introduce in the separation of the $2P_{\frac{1}{2}}$ and $2S_{\frac{1}{2}}$ levels of the $(\mu^4He)^+$ system a discrepancy between recent experiment and theory — otherwise in agreement — of the same level as the original μ-mesic atom X-ray discrepancy. (auth)

12531 K^- DECAY, HYDRIDE BONDS, AND Z-DEPENDENCE IN KAONIC ATOMS. Godfrey, G. L.; Wiegand, C. E. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Phys. Lett., B; 56: No. 3, 255-257(28 Apr 1975).

The observed low values and striking variations in kaonic X-ray intensities were found to be not due to K^- decay. Measurements on H_2O and CH show greatly reduced X-ray intensities apparently due to the presence of the hydride bonds. A simple cascade calculation with an initial distribution in n = 30 that is statistical out to various l_{max} gave agreement with the absolute X-ray intensities. A correlation between l_{max} and atomic spacing is suggested. (auth)

12532 HYPERFINE STRUCTURE OF ^{17}O π-MESIC ATOM. Partensky, A.; Thevenet, C. (Lyon-1 Univ., 69 – Villeurbanne (France). Inst. de Physique Nucleaire). Phys. Lett., B; 56: No. 3, 258-262(28 Apr 1975).

The optical potential which describes the strong interaction between the pion and the nucleus contains a spin-dependent term which gives rise to a hyperfine level splitting. This effect has been investigated in ^{17}O. It is small and mixed with the electromagnetic hyperfine effects. Nevertheless, it may induce an observable broadening of the 2p level of the π mesic atom. (auth)

Collision Phenomena

Refer also to abstracts 12508, 12634, 12788, 12890, 12895, and 12912–12914.

12533 (PTB-APh-6) INITIAL ENERGY OF PRODUCT IONS OF ION-MOLECULE REACTIONS AND ITS EFFECT IN THE DETERMINATION OF REACTION CONSTANTS BY THE TALROSE METHOD. Drewitz, H. J. (Physikalisch-Technische Bundesanstalt, Braunschweig (F. R. Germany). Abt. Atomphysik). Nov 1974. 108p. (In German). Dep. NTIS (US Sales Only) $8.50.

Velocity distributions of the secondary ions H_3^+, D_3^+, HeH^+, and CD_5^+ from the reactions $H_2^+ + H_2$, $D_2^+ + D_2$, $H_2^+ + He$, and $CD_4^+ + CD_4$ reactions were measured. The distributions are approximately quasithermal, i.e., they are approximately Maxwell-Boltzmann distributions. At an ion source temperature of 457°K values were calculated for the ratio α = average translation energy $\bar{E}$ of the secondary ions/$\bar{E}$ of the primary ions ($\bar{E}$ refers to the laboratory system). The average translation energy $^r\bar{E}$ (translation energy of the reaction products in the center-of-gravity system) was also calculated. The mean excitation energies $^i\bar{E}$ of the secondary ions were estimated on the basis of an energy balance. The $^r\bar{E}$ values of the $HeH^+ + H$ and $CD_5^+ + CD_5$ systems can be explained if one assumes a transformation of the internal energy of the reactants into the kinetic energy of the products. The larger average velocity of the secondary ions in the laboratory system in comparison with the primary ions in the study of the ions in a conventional magnetic mass spectrometer can lead to detection probabilities (discrimination). The same type of discrimination can also occur in ions with different charge. These discrimination effects were calculated and measured. The results agree within the measurement accuracy. After correction of this discrimination the reaction constants k_R were calculated. (tr-auth)

12534 (ZFK-283, pp 60-62) DETECTION OF QUASIMOLECULAR K X RADIATION IN BOMBARDMENT OF As, Zr, Nb, Mo, AND Rh TARGETS WITH Nb^{5+} IONS. Gippner, P. (Joint Inst. for Nuclear Research, Dubna, USSR); Kaun, K. H.; Sodan, H.; Stary, F.; Schulze, W.; Tretyakov, Ya. Aug 1974. (In German).

In joint annual report, 1974.

12535 (ZFK-283, pp 62-63) DETECTION OF QUASIMOLECULE RADIATION IN THE SYSTEM $_{57}La + _{57}La$. Frank, W.; Gippner, P.; Kaun, K. H.; Schulze, W.; Sodan, H.; Tretyakov, Ya. (Joint Inst. for Nuclear Research, Dubna, USSR). Aug 1974. (In German).

In joint annual report, 1974.

12536 (ZFK-283, pp 109-110) X RADIATION FROM BOMBARDMENT OF THICK Si TARGETS. Bauer, C.; Groetzschel, R.; Hohmuth, K.; Klabes, R.; Kreissig, U.; Mann, R.; Rudolph, W.; Stary, F. Aug 1974. (In German).

In joint annual report, 1974.

12537 ROTATIONAL RELAXATION IN H_2 AND D_2 DUE TO COLLISIONS WITH NOBLE GAS ATOMS. Agrawal, P. M. (Department of Physics, M. L. V. Government College, Bhilwara, Rajasthan, India); Saksena, M. P. (Rajasthan Univ., Jaipur (India). Dept. of Physics). Chem. Phys. Lett.; 32: No. 1, 123-126(1 Apr 1975).

Easily computable expressions for inelastic collision cross sections, for rotational transitions in H_2 and D_2 molecules due to collisions with inert gas atoms, have been derived, using the distorted wave approximation. $(Z_{rot})_{20}$, $(Z_{rot})_{31}$, $(Z_{rot})_{42}$, and $(Z_{rot})_{53}$ have been numerically calculated. The results are found to be in good agreement with experiment. (auth)

12538 BOUND STATE METHODS FOR ELASTIC SCATTERING PHASE SHIFTS. Oppenheimer, M.; Doyle, H.; Dalgarno, A. (Harvard Coll. Observatory, Cambridge, Mass. (USA)). Chem. Phys. Lett.; 32: No. 1, 6-10(1 Apr 1975).

Three methods are investigated for obtaining elastic phase shifts in the scattering of electrons from atoms and ions that use a bound-state representation of the scattering wavefunction. Results for singlet p-wave scattering by H and by He^+ are compared with previous calculations. (auth)

12539 ENERGY SHIFTS IN THE RELATIVE COORDINATES TREATMENT OF THE COLLINEAR COLLISION BETWEEN AN ATOM AND AN OSCILLATOR. Exponential Repulsive Potential. Atabek, O.; Beswick, J. A.; Lefebvre, R. (Centre National de la Recherche Scientifique, 91 - Orsay (France). Lab. de Photophysique Moleculaire). Chem. Phys. Lett.; 32: No. 1, 28-33 (1 Apr 1975).

The treatment of the kinetic term which may be taken as the perturbation when the collision between an atom and an oscillator is described with relative coordinates is shown to require the use of energy shifted basis functions in the calculation of the transition probabilities. For an exponential repulsive potential, a simple analytical formula is obtained for one quantum jumps in the first order Born approximation, which has a simple relationship with the first order Born distorted wave expression, and which lead to better results than the other available analytical formulas. (auth)

12540 EFFECT OF TWO-IMPACT COLLISIONS IN HF + H. Shin, H. K. (Nevada Univ., Reno (USA). Dept. of Chemistry). Chem. Phys. Lett.; 32: No. 1, 63-66(1 Apr 1975).

The effect of double-impact collisions on the vibration-translation energy transfer in collinear F-H + H collisions has been examined in the classical hard-sphere model. It is shown that as the collision energy increases the majority of collisions involve two impacts, but the two-impact collision is far less efficient than the one-impact process in exchanging the energies of vibrational and translation motion, thus leading to a diminished inelasticity. It is also shown for several different mass distributions that when the effect of impact multiplicity is introduced, the present model gives vibrational energy transfer at high collision energies that is in agreement with the results of exact trajectory calculation. (auth)

12541 ON THE THEORY OF DIRECT COLLISIONAL PROCESSES. Dubrovskiy, G.; Bogdanov, A.; Fischer-Hjalmars, I. (Leningradskij Gosudarstvennyj Univ. (USSR)). Chem. Phys.; 7: No. 3, 405-413(Mar 1975).

Eikonal formulas of the scattering amplitudes of direct atom-molecular processes are presented in the quasiclassical form. A simplified version of the potential scattering amplitude and different mechanisms of the rearrangement reaction 1 + (2,3) → 2 + (1,3) on the base of the eikonal approximation are discussed. The stationary phase method is employed for evaluation of pertinent integrals. Explicit expressions for the differential cross section of classical type are obtained in two applications. (auth)

12542 DIFFERENTIAL CROSS SECTION MEASUREMENTS OF RAINBOW STRUCTURE IN $Li^+ - Ar$, Kr and Xe. Boettner, E.; Dimpfl, W. L.; Ross, U.; Toennies, J. P. (Max-Planck-Institut fuer Stroemungsforschung, Goettingen (F. R. Germany)). Chem. Phys. Lett.; 32: No. 2, 197-200(15 Apr 1975).

The differential elastic cross sections ($\theta_{lab} < 20°$) for $Li^+ - Ar$, Kr, Xe have been measured for $3 < E_{c.m.} < 9$ eV and compared with those predicted from the electron gas theory of Gordon and Kim for closed shell systems. The experimental well depths are typically deeper than predicted by theory. The largest discrepancy of 9% was found for Li^+- Kr. (auth)

12543 BROADENING AND SHIFT OF THE TWO-PHOTON 3S-4D TRANSITION IN SODIUM ATOMS IN COLLISIONS WITH NEON ATOMS. Biraben, F.; Cagnac, B.; Grynberg, G. (Ecole Normale Superieure, Paris). J. Phys. (Paris).; 36: No. 2, L41-L43(Feb 1975). (In French).

The broadening and the shift of the 3S-4D two-photon transition without Doppler broadening in atomic sodium in collision with neon atoms, was investigated experimentally. The following values were obtained: $\alpha = 32 \pm 5$ MHz/torr for the broadening and $\beta = 7 \pm 1$ MHz/torr for the shift. This method can be used for investigating the effect of collisions on S and D levels and it needs low pressures of foreign gases (about 1 torr). (FR)

12544 EFFECT OF RESONANCE DISCREPANCIES ON QUASI-RESONANT COLLISION CROSS SECTIONS. II. The Case of a Resonance Transition J = 1 → J = 0 and Applications. Gay, J. C. (Ecole Normale Superieure, 75- Paris (France). Lab. de Spectroscopie Hertzienne; Paris-7 Univ., 75 (France)). J. Phys. (Paris).; 35: No. 11, 813-828(Nov 1974). (In French).

Resonant collision cross sections are studied for J = 1 → J = 0 transitions when the collisional excitation transfer between the atoms is not quite resonant. The relaxation and transfer rates decrease rapidly as the energy defect increases, and the emitter line is displaced by values which can be of the same order of magnitude as the line broadening due to the dipole-dipole interaction. The comparison of the numerical results with those obtained by Omont using the second-order semi-classical Born approximation and a cut-off method, reveals the failure of such methods to describe the collisional transfer as soon as it becomes non-resonant. The validity of the use of such an approximation to account for the rotational transfer during molecular collisions has to be verified carefully. The results are applied to some physical situations H-D collisions and the heavy elements Hg, Pb and extensions of the work are mentioned. (auth)

12545 ELECTRON EXCITATION OF MOLECULES. Nedelec, O. (Grenoble-1 Univ., 38- Saint-Martin-d'Heres (France)). pp 41-48 of Methods of Doppler Natural Linewidth Spectroscopy of Excited Levels in Simple Molecular Systems. Paris, France; Centre National de la Recherche Scientifique (1974). (In French)

From international colloquium on Doppler linewidth spectroscopy of excited levels in simple molecular systems; Aussois, France (23 May 1973).

A scope is given on the work made recently on the excited states of diatomic molecules, by techniques which involve the polarization of the light emitted after electron impact. (auth)

12546 RELATIVE INTENSITIES AND POLARIZATIONS IN H_2 ROTATIONAL LINES EXCITED BY ELECTRON IMPACT.

Baltayan, P.; Nedelec, O. (Grenoble-1 Univ., 38 (France)). J. Phys. (Paris).; 36: No. 2, 125-133(Feb 1975).

The relative values of the intensities and polarizations in H_2 rotational lines in a band excited by electron impact are calculated in the united atom approximation by vector addition. They are valid at any electron energy beyond threshold. Experiments made on the $3p^3\Pi_u \rightarrow 2s^3\Sigma_g^+$ bands show reasonable agreement with the theory. Cascade effects are discussed. (auth)

12547 NATURAL LINEWIDTH SPECTROSCOPY OF EXCITED STATES OF H_2. Miller, T. A.; Freund, R. S. (Bell Labs., Murray Hill, N. J. (USA)). pp 201-219 of Methods of Doppler Natural Linewidth Spectroscopy of Excited Levels in Simple Molecular Systems. Paris, France; Centre National de la Recherche Scientifique (1974).

From international colloquium on Doppler natural linewidth spectroscopy of excited levels in simple molecular systems; Aussois, France (23 May 1973).

Microwave optical magnetic resonance induced by electrons (MOMRIE) was used to study level states of H_2 and D_2. Ab initio calculations are compared with the observed experimental data. (auth)

12548 THEORY OF NEUTRAL ATOM-CRYSTAL COLLISIONS IN THE FRAMEWORK OF THE HARMONIC APPROXIMATION. Armand, G. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Service de Physique Atomique). J. Phys. (Paris).; 36: No. 1, 75-95(Jan 1975). (In French).

Using the sudden approximation scheme, the interaction of a particle, coming from a gas phase, with a semi-infinite three-dimensional harmonic lattice is described. The surface potential is equal to a sum of harmonic potentials over a limited number of surface atoms. The projection of the initial old phonons onto the final new phonons is performed. Equations for the evolution of the position and velocity operators for each atom are obtained as a sum of products of Green functions, dependent on time through the corresponding position or velocity operators of the particles before the interaction. It is then shown that, in the absence of induced localized surface modes arising from the interactions of the incident particle, the Green functions vanish in the limit of infinitely long times. Consequently the system tends to thermal equilibrium, as indicated by the behavior of the correlation functions. The incident particle may be captured. With localized surface modes of frequencies Ω_1, the Green functions tend to a linear combination of the sin (Ω_1 tau). For this model, the crystal and the interacting particle are always out of thermal equilibrium in this case. The particle-lattice energy exchange may be reduced. The reemission of the particle into the gas phase is studied using classical mechanics and a semi-infinite simple cubic lattice model, in order to reduce the numerical computations. The velocity distribution of the particles reflected normally from the surface is calculated, from which it is easy to compute the reemission lobe, assuming the conservation of the incident tangential momentum. This velocity distribution contains the parameters of the collision, the mean square displacement of a surface atom and the Green functions, respectively, of the incident atom in the surface potential and of the crystal atom with which its interacts directly. By a perturbation method, the Green functions are exactly calculated. Some numerical results are compared with the experimental data in the case of helium collisions on silver (111). They show that a localized surface mode appears during the particle-surface interaction, the frequency of which is approximately three times as high as the maximum frequency in the bulk. (auth)

12549 RADIATIVE ELECTRON CAPTURE AND BREMSSTRAHLUNG. Schnopper, H. W.; Delvaille, J. P. (Massachusetts Inst. of Technology, Cambridge). pp 481-498 of Atomic Collisions in Solids. Vol. 2. Datz, S. (ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

The applicability of radiative electron capture (REC) as a means for investigating the electron momentum distribution of target electrons in atomic collisions is discussed. A model based on an impulse approximation is used to predict the position, shape, and cross section for the REC spectral feature. Experimental results obtained for proton, lithium, carbon, and oxygen projectiles incident on various gaseous targets are presented. (6 figures) (auth)

12550 HYBRID COMPUTATIONAL STUDIES OF ELASTIC SCATTERING OF ATOMS. Pearce, J.; Crosbie, R. E.; Armour, D. G.; Carter, G. (Univ. of Salford, Eng.). pp 611-624 of Atomic Collisions in Solids. Vol. 2. Datz, S. (ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

Initially an analog computer, and subsequently a hybrid computer, were used to simulate the trajectories of colliding atoms acting under a central Born-Meyer interatomic potential. Studies of the binary elastic interaction between a single Ar atom and an Au atom and the multiple collision between an Ar atom and two neighboring Au atoms were undertaken and the relationships between energy retained by the scattered atom and scattering angle were deduced for various incidence conditions of initial energy, impact parameter and Born-Mayer constants. The results are shown to agree well with digital simulation studies and several new features of the interaction process are explored. (8 figures, 18 references) (auth)

12551 COMBINATION OF DECHANNELING AND ENERGY MEASUREMENTS OF PROTONS IN THIN SILICON SINGLE CRYSTALS. Goetz, G.; Klinge, K. D.; Finger, U. (Friedrich-Schiller-Univ., Jena, Ger.). pp 693-716 of Atomic Collisions in Solids. Vol. 2. Datz, S. (ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

A special backscattering technique has been used to measure dechanneling and energy loss of protons in thin monocrystals of silicon (1-4 mu m) simultaneously. At the back of the crystalline targets a very thin layer of carbon or LiF was deposited. Backscattering of the protons on these layers was used for the measurement of the energy-loss ratio alpha equals (dE/dt)/sub hkl//(dE/dt)/sub random/ in the energy range E/sub p/ equals 0.7 to 1.6 MeV. We found alpha equals 0.69 +- 0.03 in [111] and alpha equals 0.52 + - 0.03 in [110] direction. In connection with this, the energy loss distribution and the dechanneling at incidence angles of $0^0 - 1^0$ in relation to the [111] and [110] axis were measured. Also investigated was the variation of dechanneling and energy loss distribution with the amount of radiation damage, introduced by implantation of argon ions. The experimental results for dechanneling along the [110] and [111] axis are in relatively good agreement with calculations in which nuclear contributions of the second order were considered and a more realistic potential was used. (12 figures, 23 references) (auth)

12552 EXPERIMENTAL INVESTIGATION OF THE REVERSIBILITY RULE AT NONZERO DEPTH. Campisano, S. U.; Foti, G.; Grasso, F.; Rimini, E. (Univ. di Catania, Italy). pp 749-763 of Atomic Collisions in Solids. Vol. 2. Datz, S. (Ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

The validity of the reversibility rule between source and detector has been tested by experiments on channeling and blocking performed just beyond the crystal surface. The measurements have been extended to finite depth inside the crystal by MeV proton backscattering from main axes of Si and Ge. The aligned yield in blocking is higher than that corresponding in channeling for all the investigated beam energies, crystal axes and target temperatures. No direct comparison can be made in this case between channeling and blocking because in channeling experiments all the detected dechanneled particles come from a monoenergetic source, while in blocking the detected channeled particles originate from sources of different energies because of the energy losses experienced by the incident particles along the incoming random trajectories. For a comparison between channeling and blocking all the blocking sources are normalized to the same energy as the channeling source. The simple scaling parameter z/E has been used for this reduction on the basis of experimental dechanneling results and for the lack of a quantitative theoretical prediction. The corrected blocking aligned yield remains slightly higher (10 to 20 percent) than the corresponding channeling one, and the reversibility rule seems then to be valid, even in the occurrence of multiple scattering, within 20 percent in the framework of this simple data treatment. (auth)

12553 REACTIVE SCATTERING OF MOLECULAR BEAMS. Fluendy, M. A. D. (Univ. of Edinburgh). Contemp. Phys.; 16: No. 2, 147-172(Mar 1975).

The rate and mechanism of chemical change was studied for many years but until recently experimental work was concerned with bulk systems so that the microscopic level of action was manifest only in some average way. In contrast, methods such as x-ray scattering yield direct information on molecular structure. The technique of molecular beam scattering is now a similar tool, capable of probing the dynamics of chemical reactions at the molecular level and leading to an understanding of the process in terms of the trajectories of the atoms participating. Discussion

of the reaction is thus naturally in quantum channel cross section terms; a change in emphasis, from conditions in the bulk sample to the collision proper, which has stimulated theoretical work. In particular, concepts and techniques developed for use in the atomic and nuclear collision field have been extended into this area. These rather rigorous calculations will be limited to the very simplest systems but, nevertheless, will form an important proving ground for more approximate models. (auth)

Atomic Theory

Refer also to abstract 12934.

12554 TWO-PARTICLE, TWO-HOLE CORRECTIONS TO A SELF-CONSISTENT TIME-DEPENDENT HARTREE-FOCK SCHEME. Joergensen, P.; Oddershede, J. (Aarhus Univ. (Denmark)); Ratner, M. A. (New York Univ., N. Y. (USA)). Chem. Phys. Lett.; 32: No. 1, 111-115(1 Apr 1975).

It is shown that the effect of two-particle, two-hole excitations can be included in a self-consistent time-dependent Hartree–Fock model. Both corrected excitation energies and oscillator strengths are calculated. Especially the singlet spectrum is influenced by this perturbation. (auth)

12555 ON THE USE OF MODEL POTENTIALS WITH FLOATING TYPE OF WAVEFUNCTIONS. Semkow, A. M.; Suthers, R. A.; Linnett, J. W. (Cambridge Univ. (UK). Dept. of Physical Chemistry). Chem. Phys. Lett.; 32: No. 1, 116-122(1 Apr 1975).

The model potential method has been applied to an FSGO wavefunction in a manner suggested recently by Barthelat and Durand. Analysis of the theory of model potentials and exemplary calculations on first row atom hydrides indicate that the model potential method cannot in general be applied to the floating type of wavefunction. (auth)

12556 COMPARISON BETWEEN EQUATIONS-OF-MOTION AND GREEN'S FUNCTION METHODS FOR THE PARTICLE-HOLE RESPONSE FUNCTION. Tsui, F. S. M.; Freed, K. F. (Chicago Univ., Ill. (USA). Dept. of Chemistry). Chem. Phys. Lett.; 32: No. 2, 345-350(15 Apr 1975).

It is shown that, apart from a few differences, the equations-of-motion method of McKoy et al. provides the leading correction to the random phase approximation (with exchange) in the fully renormalized response function (density-density correlation function). Thus, their equations-of-motion method is shown to be equivalent to a partial summation of infinite sets of terms in the perturbation expansion of the response function. (auth)

12557 DENSITY OSCILLATIONS AND DENSITY RESPONSE IN SYSTEMS WITH NONUNIFORM ELECTRON DENSITY. Mukhopadhyay, G.; Lundqvist, S. (Chalmers Univ. of Tech., Goteborg). Nuovo Cim.; 27B: No. 1, 1-18(11 May 1975).

A formulation for the density response of systems with inhomogeneous electron density is presented. The treatment allows a separation of the response into a classical instantaneous part which is a function of electron density alone, and a retarded dynamic part that depends on the details of the excitation energies and wave functions of the system. This enables one to understand which properties of a system are determined essentially by the classical part and which by the dynamic part. As an application and illustration of studying in a unified manner adverse systems, such as a semi-infinite electron gas, electron distribution in defects and electrons in atoms, the classical part alone was studied and some simple results related to the density oscillations in the system were derived. (auth)

12558 ATOMIC PHYSICS, MASS SPECTROMETRY, HIGH FREQUENCY PHYSICS, MOLECULAR PHYSICS, AND QUANTUM OPTICS. Spring Conference of the German Society of Physics, Cologne, Germany, February 24–March 1, 1975. Verhandlungen der Deutschen Physikalischen Gesellschaft, No. 1. Weinheim, Ger.; Physik Verlag GmbH (1975). 135p. (In German and English). (CONF-750228-(Absts.)).

Abstracts of the papers presented at the conference are compiled. (JSR)

12559 RELAXATION TO QUANTUM-STATISTICAL EQUILIBRIUM OF THE WIGNER–WEISSKOPF ATOM IN A ONE-DIMENSIONAL RADIATION FIELD. VII. Emission in a Finite System in the Presence of an Extra Photon. Davidson, R.; Kozak, J. J. J. Math. Phys. (N.Y.); 16: No. 5, 1013-1022(May 1975).

The exact solution to a problem previously unsolved in radiation theory is presented; the emission of a two-level atom in a (one-dimensional) radiation field in the presence of extra photon. The solution is obtained directly from the Schroedinger equation of the problem using techniques suggested by the work of Muskhelishvili on singular integral equations. The solution corresponding to a finite system as well as the one corresponding to a system infinite in extent are given, although the primary concern is the finite-system problem. For a particular choice of initial condition, the probability of time t that the two-level atom is in the excited state is found, and the effects of system size and choice of coupling function are studied numerically for a given coupling constant. The results are compared with those obtained in earlier paper for the series, wherein the spontaneous emission of a Wigner-Weisskopf atom in a (one-dimensional) field of radiation for a system finite in extent was studied. The physical effects calculated and the conclusions drawn from our comparative studies are all in accord with simple intuition regarding the problem. Some brief remarks are given on problems in radiation theory which are accessible to study given the methods laid down. (auth)

12560 RESPONSE OF A TWO-LEVEL SYSTEM TO A SEQUENCE OF N RADIATION PULSES. Venkatesh, H. G.; Sarkar, G. G. (Birla Inst. of Tech., Mesra, Ranchi, India). Pramana.; 4: No. 3, 130-139(Mar 1975).

A general expression was obtained for the polarization of an assembly of two-level systems irradiated by a sequence of N radiation pulses. The times and amplitudes of the echo-polarization were obtained. The method is an extension of the T-matrix method for the exact solution of the problem of interaction of radiation with two-level systems. The number of polarization echoes is $3^{N-1} - N$. The echo times are given by $t' = (1 + a)t_N + (b - a)t_{N-1} + (c - b)t_{N-2} + \ldots + (q - p)t_1$ where t_k are the pulse times and a, b, c take on values 1, 0, −1. From the general expression the amplitudes of echoes due to sequences of 2, 3 and 4 pulses are obtained as special cases. Distinct echo sequences determined by time relations among the incident pulses are discussed. The echo sequences exhibit interesting features which are of significance in the application of the phenomenon in holophony, etc. (auth)

12561 MOELLER–PLESSET THEORY FOR ATOMIC GROUND STATE ENERGIES. Binkley, J. S.; Pople, J. A. (Carnegie-Mellon Univ., Pittsburgh). Int. J. Quant. Chem ; 9: No. 2, 229-236 (Mar 1975).

Moeller–plesset theory, in which electron correlation energy is calculated by perturbation techniques, is used in second order to calculate energies of the ground states of atoms up to neon. The unrestricted Hartree-Fock (UHF) Hamiltonian is used as the unperturbed system and the technique is then described as unrestricted Moeller-Plesset to second order (UMP2). Use of large Gaussian basis sets suggests that the limiting UMP2 energies with a complete basis of s, p, and d functions account for 75 to 84 percent of the correlation energy. Preliminary estimates of the contributions of basis functions with higher angular quantum numbers indicate that full UMP2 limits give even more accurate total energies. (auth)

PHYSICS (ELECTROFLUID AND MAGNETOFLUID)

12562 WILLIAMS INSTABILITY IN A POISENILLE FLOW: EXPERIMENTS. Guyon, E.; Pieranski, P. (Paris-11 Univ., 91-Orsay (France). Lab. de Physique des Solides). Compt. Rend., Ser. A, B; 280: No. 7, 187-188(17 Feb 1975). (In French).

A recent prediction by de Gennes has indicated that the threshold of the classical electrohydrodynamic Williams instabilities in nematics should be increased in the presence of a flow perpendicular to the axis of the rolls. This effect and the decrease of the wavelength of the convective rolls as the flow velocity increases are well described from experiments on M. B. B. A. A new convective mode involving rolls along the unperturbed director axis and a strong hysteresis is obtained for finite amplitudes of the distortion. (FR)

12563 LIMITING BEHAVIOR AND STABILITY OF SOME MAGNETOHYDRODYNAMIC FLOWS. Sanchez-Palencia, E. (Paris-6 Univ., 75 (France)); Tsinober, A. B. (AN Latvijskoj SSR, Riga. Inst. Fiziki). J. Mec.; 13: No. 4, 622-637(Dec 1974). (In French).

MHD flows at small magnetic Reynolds number are considered. The limiting behavior of such flows as the Hartmann number M tends to infinity is studied under the following essential hypothesis: every point of the flow domain lies at a finite distance (in the direction of the applied magnetic field) from an electrically conducting body. Under the same conditions, the stability of flows with sufficiently large M is proved. (FR)

12564 MAGNETO-ACOUSTIC RESONANCES GENERATED BY A MAGNETIC FIELD. Chambarel, A. (Centre Universitaire d'Avignon, 84 (France)). J. Mech.; 13: No. 4, 655-677(Dec 1974). (In French).

A cylinder of electrically conducting fluid is placed in an axial magnetic field including a steady component and an unsteady one. The theory reveals the existence of a radial motion and of resonant frequencies. A theoretical and experimental study is made in the case of mercury. The experimental results accord reasonably well with the theory. This rather simple system opens new possibilities for generating vibrations, without electrode or emitter within the fluid. (auth)

12565 ACCELERATION BY A UNIFORM MAGNETIC INDUCTION OF AN ELECTRICALLY CONDUCTING VISCOUS LIQUID PLACED IN A STRAIGHT RECTANGULAR CROSS SECTION CHANNEL AND DRAGGED BY A SLIDING INFINITE CONDUCTING WALL. Herve, P.; Poirier, Y. (Centre Universitaire de Saint-Denis, 974- Reunion (France)). Compt. Rend., Ser. A, B; 280: No. 4, 53-56(27 Jan 1975). (In French).

A theoretical study is made of an electrically conducting viscous liquid flowing in a straight channel of rectangular cross section two walls of which, parallel to a uniform magnetic induction, are electrically insulating. The other walls, one fixed and the other driven by a uniform movement, are supposed infinitely conducting. These formulae give the law of speed distribution in the straight section of the flow as a function of the coefficient of form of that section and the Hartman's number. The curves show the acceleration effect produced in each section by the application of the magnetic induction and the electric current distribution in the case of a square cross section. (FR)

PHYSICS (HIGH-ENERGY)

12566 ANALYTIC EXTRAPOLATION TECHNIQUES AND STABILITY PROBLEMS IN DISPERSION RELATION THEORY. Ciulli, S.; Pomponiu, C.; Sabba-Stefanescu, I. (Institutul de Fizica Atomica, Bucharest (Romania)). Phys. Rep.; 17: No. 4, 133-224 (Apr 1975).

The point is made that, in an indirect science like elementary particle physics, it is not sufficient to have a specific description of the world brought by some happy inspiration, but rather it is necessary to optimize among large classes of (preferably among all) possible equivalent revelations. In those situations when the basic laws are inherited from other fields their concepts may prove to be very remote from experiment. To cope with this situation, one has first to introduce some new (experimentally or theoretically measurable) quantities, extraneous to the inherited theory, with the purpose of delimiting some compact sets inside which stable solutions of inverse problems can be sought. Mathematically equivalent descriptions are often rendered inequivalent by the ever-existing regions where experimental knowledge is lacking or incomplete. It is argued that this breaking of tautologies is due to the fact that the randomness of ignorance destroys just those delicate mathematical properties (for instance, absolute analyticity of the input) which had rendered the methods equivalent in the ideal case of total knowledge. Therefore it is of practical relevance to find, among all the previous tautologic methods, that one which is least affected by our limited amount of knowledge. This paper treats the incidence of these questions in some theoretical and phenomenological problems of particle physics, in which analytic continuation is used at least as an intermediate step. (auth)

Particle Interactions and Properties (Experimental)

Refer also to abstracts 12599, 12600, and 12606.

12567 SELF CORRELATIONS IN GASES OF LINEAR MOLECULES WITH APPLICATION TO THERMAL-NEUTRON SCATTERING. Geckinli, M.; Ferziger, J. H. (Stanford Univ., Calif. (USA). Dept. of Mechanical Engineering). Physica; 78: No. 3, 347-364 (15 Dec 1974).

A phenomenological linear Boltzmann equation is derived to study the classical motion of a rigid linear test molecule in a gaseous medium. The state of the molecule is defined by its center-of-mass coordinate and velocity, rotation frequency, orientation of its angular momentum and a rotor phase angle. The thermal-neutron scattering cross section is derived from a Fourier transform of a density distribution function which satisfies the Boltzmann equation with a suitable initial condition. Cross sections are calculated for some models to indicate the effect of coupling of center of mass and internal behavior. (auth)

12568 HIGH ENERGY PHYSICS INDEX. Volume 13, No. 6, 1975. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1975). 102p.

12569 HIGH ENERGY PHYSICS FILE 5. Following the Tracks. Walgate, R. New Sci. (London).; 66: No. 946, 184-187 (24 Apr 1975).

Events, caused by the interaction of particle beams with targets, produce a collection of new particles. By consideration of the results of an enormous number of such events, charm, neutral currents and gauge theories are studied. The detection, tracking and observation of the particles is discussed. (UK)

Electromagnetic

Refer also to abstract 12772.

12570 REMARKS ON A NORMALIZATION OF THE CURVES OF ANGULAR DISTRIBUTIONS OF e^-e^+ PAIRS ANNIHILATION QUANTA. Dworakowski, J.; Kukulka, J. (Department of Physics, Pedagogical University, Czestochowa, Poland). Phys. Lett., A; 51: No. 5, 257-258(24 Mar 1975).

A normalization procedure is proposed for the measurement of the two and three positron annihilation quantum decay rates. An apparatus coefficient α has been introduced which expresses the measured to total triple decay rates and a method of measuring this was indicated. (auth)

12571 MEASUREMENT OF TOTAL HADRONIC PHOTOABSORPTION CROSS SECTION ON CARBON FROM 14 to 34 GeV. Bayatyan, G. L.; Grigoryan, N. K.; Knyazyan, S. G.; Margaryan, A. T.; Vartanyan, G. S. (Erevanskij Fizicheskij Inst. (USSR)); Alikhanyan, A. I. (Lebedev Physics Institute, USSR); Frolov, A. M. (Institute of High Energy Physics, USSR). Phys. Lett., B; 56: No. 2, 197-200(14 Apr 1975).

The data on total cross sections of hadronic photoabsorption in carbon nuclei as obtained by the conventional tagged photon method are given for five values of energy in the 14-34 GeV interval. A slight drop of the cross section curve with the increase in energy is observed, indicating the contribution of the ρ'-meson to the total cross section. (auth)

12572 REDUCTION OF THE STATE VECTOR: A PROPOSED COINCIDENCE EXPERIMENT. Szczepanski, A. (Inst. of Fundamental Technological Research, Warsaw). Bull. Acad. Pol. Sci., Ser. Sci. Tech.; 22: No. 11, 989-991(1974).

The principle of a low intensity photon beam coincidence experiment is discussed. The proposed experiment differs from the usual ones in replacing of the photomultiplier detectors by a device which can be regarded as an emission detector. The possibility of obtaining information about the kinematics of the "state vector collapse" process of the photon is pointed out along with a limitation to the semiclassical radiation theories. (auth)

12573 DETERMINATION OF THE EFFECTIVE MASS OF THE LOCALIZED ELECTRON IN DENSE HELIUM GAS FROM SPACE-CHARGE-LIMITED CURRENTS. Howell, J.; Silver, M. (Univ. of North Carolina, Chapel Hill). Phys. Rev. Lett.; 34: No. 15, 921-924(14 Apr 1975).

The effective mass of the localized electron in dense helium gas at 4.2^0K was determined from measurements of space-charge-limited currents. A value of about 3 helium masses from the results was derived. (auth)

Weak

12574 (BNL-20013) MEASUREMENT OF THE RATIO OF NEUTRINO TOTAL CROSS SECTIONS ON HYDROGEN AND DEUTERIUM IN THE BROOKHAVEN 7-FT. BUBBLE CHAMBER. Cazzoli, E. G.; Cnops, A. M.; Connolly, P. L.; Louttit, R. I.; Murtagh, M. J.; Palmer, R. B.; Samios, N. P.; Tso, T. T.; Williams, H. H. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 21p. (CONF-750307-6). Dep. NTIS $4.25.

From international colloquium of the CNRS on neutrino physics at high energy; Paris, France (18 Mar 1975).

Charged current neutrino interactions obtained in hydrogen and deuterium as a function of charged track multiplicity are presented. The ratio of neutrino fluxes in the two exposures is obtained from the two samples of the reaction nu p yields mu$^-$ p pi$^+$. The ratio of total charged current cross sections on hydrogen and deuterium is thus obtained and presented as a function of neutrino energy. The result obtained for neutrino energies above 2 GeV is: sigma (H_2)/ sigma (D_2) equals 0.40 +- 0.10. (auth)

12575 (BNL-20117) CHOICE OF TARGET FOR NARROW-BAND (DICHROMATIC) NEUTRINO BEAM. Kalbfleisch, G. R. (Brookhaven National Lab., Upton, N. Y. (USA)). May 1975. 9p. Dep. NTIS $4.00.

It is found that a 5-6" long Cu target should be used for the target of the N.B. neutrino beam. (auth)

12576 A STUDY OF THE SEMI-LEPTONIC DECAYS OF K^+ MESONS. Braun, H.; Cornelssen, M.; Martyn, H. U. (Technische Hochschule Aachen (F. R. Germany). 3. Physikalisches Inst.); Erriquez, O.; Natali, S.; Romano, F. (Bari Univ. (Italy). Istituto di Fisica); Bertrand, D.; Csejthey-Barth, M.; Lemonne, J.; Renton, P. Nucl. Phys., B; 89: No. 2, 210-252(21 Apr 1975).

The form factors of the semileptonic decays $K^+ \to \pi^0 e^+ \nu$ and $K^+ \to \pi^0 \mu^+ \nu$ have been investigated using a sample of events detected in the CERN 1.1 m^3 heavy liquid bubble chamber. Analyses have been carried out using methods independent of any assumption of the q^2 dependence of the form factors in addition to the usual linear parametrizations. Consistent results have been obtained from separate studies of both Dalitz plot density distributions and the branching ratio. A parametrized global analysis of both decay modes gives the values $\xi(0) = -1.3 \pm 0.7$ and $\xi(4.4\ M_\pi^2) = -0.45 \pm 0.13$, or $\lambda_0 = -0.017 \pm 0.011$ both for a fitted value of $\lambda_+ = 0.025 \pm 0.007$. (auth)

12577 OBSERVATION OF THE $K^+ \to \pi^+ e^+ e^-$ DECAY. Bloch, P.; Brehin, S.; Bunce, G.; Devaux, B.; Diamant-Berger, A. M.; Do-Duc, N.; Marel, G.; Turlay, R. (CEA Centre d'Etudes Nucleaires de Saclay, 91- Gif-sur-Yvette (France). Dept. de Physique des Particules Elementaires); Extermann, P.; Fischer, J. Phys. Lett., B; 56: No. 2, 201-204(14 Apr 1975).

The observation of 41 $K^+ \rightarrow \pi^+e^+e^-$ decays resulting from a counter experiment on K_{e4} decay performed at CERN is reported. The branching ratio assuming a uniform phase space distribution is found to be $(2.6 \pm 0.5) \times 10^{-7}$. (auth)

12578 CHARGED HADRON MULTIPLICITIES AND TOPOLOGIES IN INELASTIC μ^-p SCATTERING. Ballam, J.; Bloom, E. D.; Carroll, J. T.; Chadwick, G. B.; Cottrell, R. L. A.; Della Negra, M.; Destaebler, H.; Gershwin, L. K.; Keller, L. P.; Mestayer, M. D. (Stanford Linear Accelerator Center, Calif. (USA)). Phys. Lett., B; 56: No. 2, 193-196(14 Apr 1975).

The final state charged-hadron multiplicities and topological cross sections are reported for inelastic scattering of 16 GeV μ^-'s from hydrogen in the SLAC 40-inch bubble chamber. It is found that for $1.8 \leq W \leq 5.0$ GeV the charged hadron multiplicity is generally lower at $Q^2 = 1.5$ GeV^2 than for photoproduction. (auth)

12579 NEW PARTICLES. Jacob, M. (European Organization for Nuclear Research, Geneva (Switzerland)). Bull. Union Physiciens; 69: No. 571, 481-484(Feb 1975). (In French).

The consequences of the properties of the new vector mesons discovered at Stanford (J PSI) on particle theory are discussed. (FR)

Strong (Baryon-induced)

Refer also to abstract 12289.

12580 (ANL/HEP-PR-75-17) STOPPING NEGATIVE PARTICLES IN CHEMICAL COMPOUNDS. Derrick, M. (Aerolab Development Co., Pasadena, Calif. (USA)). 1974. 8p. (CONF-750547-1). Dep. NTIS $4.00.

From fourth international symposium on NN interactions; Syracuse, New York, USA (2 May 1975).

An experiment was performed to determine the fraction of antiprotons annihilating in propane. Also discussed is large mesonic molecule formation in negative pion capture measurements. (JFP)

12581 (BNL-20118) MEASUREMENT OF "NEUTRON SEA" AT MPS. Alspector, J.; Kalbfleisch, G. R.; Strand, R. C. (Brookhaven National Lab., Upton, N. Y. (USA)). May 1975. 4p. Dep. NTIS $4.00.

Most of the triggers are expected to be due to accidental neutron sea counts in our neutron counter. If the neutron sea is too high, this would lead to an unacceptable number of accidental events. Therefore, the level of background neutrons was measured. The experimental apparatus is described, and the neutron rate is given. (JFP)

12582 (ZFK-283, pp 15-16) AVERAGE VALUE OF THE NEUTRON-NEUTRON SCATTERING LENGTH FROM A CRITICAL COMPILATION OF PUBLISHED MEASUREMENTS. Kuehn, B. Aug 1974. (In German).

In joint annual report, 1974.

12583 SEARCH FOR A $\Delta\Delta(1236)$ COMPONENT OF THE DEUTERON. Aladashvili, B. S.; Glagolev, V. V.; Lebedev, R. M.; Nioradze, M. S.; Saitov, I. S.; Streltsov, V. N. (Joint Inst. for Nuclear Research, Dubna (USSR)); Badelek, B.; Siemiarczuk, T.; Stepaniak, J. (Warsaw Univ. (Poland). Instytut Fizyki Doswiadczalnej); Nassalski, J. Nucl. Phys., B; 89: No. 3, 405-412(28 Apr 1975).

The $dp \rightarrow nnp\pi^+$, $dp \rightarrow ppn\pi^0$ and $dp \rightarrow ppp\pi^-$ reactions at 3.33 GeV/c deuteron momentum on the proton target were studied in order to search for a $\Delta\Delta$ configuration in the deuteron. The frequent backward emission of the $(p\pi^+)$, $(n\pi^0)$, and $(p\pi^-)$ systems in the deuteron rest frame was observed. The origin of the effect was analyzed from the point of view of a possible $\Delta\Delta$ admixture in the deuteron wave function. Some other sources which may contribute to the signal are indicated. (auth)

12584 AN INCLUSIVE STUDY OF π^-, K^0 AND Λ PRODUCTION FROM pn REACTIONS AT 11.6 GeV/c. Hochman, D.; Eisenberg, Y.; Engler, A.; Karshon, U.; Ronat, E. E.; Shapira, A.; Yekutieli, G. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Nuclear Physics). Nucl. Phys., B; 89: No. 3, 383-404(28 Apr 1975).

Cross sections, multiplicities and particle inclusive spectra are presented for π^-, K^0, and Λ produced in pn reactions at 11.6 GeV/c beam momentum. The results are compared with the data from pp interactions in the same energy range. Correlations between two π^- are also discussed. The main results are: the π^-, K^0, and Λ all behave similarly as a function of transverse momentum squared; π^- in the forward c.m. hemisphere have spectra in x and y consistent with that of pp interactions, whereas the spectra of π^- in the backward hemisphere fall off more slowly with $|x|$ and $|y|$ than those in the forward hemisphere, suggesting n-fragmentation effects. The K^0 and Λ have x and y distributions roughly similar to those in pp interactions. The K^0 and Λ are consistent with a modified form of KNO scaling. (auth)

12585 A SEARCH FOR SLOW MASSIVE PARTICLES WITH $Z \leq 2$ AT THE CERN INTERSECTING STORAGE RINGS. Jovanovich, J. V.; Millar, T. W.; O'Connor, P. (Manitoba Univ., Winnipeg (Canada). Dept. of Physics); Bozzo, M.; Boehm, A.; Foeth, H.; Hansroul, M.; Maderni, G.; Rubbia, C.; Staude, A. Phys. Lett., B; 56: No. 1, 105-108(31 Mar 1975).

A large scintillation counter telescope positioned at right angles to the crossing beams at the CERN ISR was used in a search for slow (stopping) massive particles with charges $Z \leq 2$. No events which could be unambiguously identified as being due to unknown particles were seen among 10^8 charged particles which passed through the telescope. (auth)

Strong (Meson-induced)

Refer also to abstract 11614.

12586 POLARIZATION MEASUREMENTS IN π^+p ELASTIC SCATTERING FROM 0.60 TO 2.65 GeV/c. Martin, J. F.; Sleeman, J. C. (Oxford Univ. (UK)); Brown, R. M.; Duke, P. J.; Evans, W. M.; Groves, E. S.; Hill, R. E.; Holley, W. R.; Jones, D. P.; Thresher, J. J. Nucl. Phys., B; 89: No. 2, 253-286(21 Apr 1975).

This paper presents the results of a counter experiment at the Rutherford Laboratory, in which the polarization parameter in π^+p elastic scattering was measured. Data were taken at 64 incident pion momenta between 0.60 and 2.65 GeV/c. The results are found to be in generally good agreement with those of other experiments, and have substantially higher precision at many momenta. (auth)

12587 PARTIAL-WAVE ANALYSIS OF THE (KKK) SYSTEM IN THE REACTION $K^-p \rightarrow K^-K^-K^+p$ AT 10 AND 16 GeV/c. Otter, G.; Rudolph, G.; Rumpf, K.; Wieczorek, H. (Technische Hochschule Aachen (F. R. Germany). 3. Physikalischens Inst.); Roloff, H.; Walter, M.; Cocconi, V. T.; Hansen, J. D.; Humble, S.; Morrison, D. R. O. Nucl. Phys., B; 89: No. 2, 201-209(21 Apr 1975).

The reaction $K^-p \rightarrow K^-K^-K^+p$ is shown to have properties similar to those of the diffractive reaction $K^-p \rightarrow K^-\pi^-\pi^+p$. This is true, at least in first approximation, for (a) the energy dependence of the cross sections, (b) the shape of the three meson spectra and (c) the differential cross sections $d\sigma/dt_{pp}$ which have the same slope for the same mass of the three-meson system. Furthermore, the partial-wave composition of the (KKK) system is similar to that of the ($K\pi\pi$) system, both systems being produced mostly in unnatural spin-parity states by natural parity exchange. In the KKK system, the $J^P = 1^+$ state with S-wave decay into $K\phi(1020)$ is dominant, $(72 \pm 11)\%$ of all events with (KKK) masses below 2 GeV. (auth)

12588 APPROACH TO SCALING IN PROTON FRAGMENTATION STUDIED IN THE REACTIONS $K^+p \rightarrow \pi^+X$ AND $K^-p \rightarrow \pi^+X$. Baker, P. A.; Barnham, K. W. J. (Imperial Coll. of Science and Technology, London (UK). Dept. of Physics); Buschbeck, B.; Markytan, M. (Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Hochenergiephysik); Carney, J. N.; Colley, D. C.; James, M.; Jones, G. T.; Scherratt, D. (Birmingham Univ. (UK)); Dunwoodie, W. Nucl. Phys., B; 89: No. 2, 189-200 (21 Apr 1975).

Data are presented on inclusive single particle distributions in the proton fragmentation region for the reactions $K^+p \rightarrow \pi^+X$ at 8.2 and 16 GeV/c and $K^-p \rightarrow \pi^+X$ at 10 and 16 GeV/c. The energy dependence is studied and compared with the dual Regge model predictions for approach to scaling. None of the existing models is in full agreement with the data. The model of Chan and his collaborators is consistent with the results under the additional assumption of equality of vector and meson coupling constants in the $p\pi^+$ vertex in the Mueller diagram. (auth)

12589 STUDY OF THE INCLUSIVE REACTION $K^+p \rightarrow K^0 +$ ANYTHING AT 5, 8.2 AND 16 GeV/c IN THE PROTON FRAGMENTATION REGION. Ciapetti, G.; Dunwoodie, W.; Goldschmidt-Clermont, Y.; Grant, A.; Sekera, Z.; Stergiou, A.; Tuominiemi, J.; Yamdagni, N. (European Organization for Nuclear Research, Geneva (Switzerland)); Carney, J. N.; Colley, D. C. Nucl. Phys., B; 89: No. 3, 365-382(28 Apr 1975).

The inclusive reaction $K^+p \rightarrow K^0X$ is studied at 5, 8.2, and 16 GeV/c. The inclusive cross sections as well as the inclusive transverse and longitudinal distributions are given. The energy dependence of the structure function in the proton fragmentation region is found to be consistent with s^{-1} behavior indicating the presence of $f' - \phi$ exchange in the missing mass channel, with a relative contribution of 50 to 70%. (auth)

12590 INCLUSIVE ρ^0 PRODUCTION IN π^-p INTERACTIONS AT 205 GeV/c. Winkelmann, F. C.; Bingham, H. H.; Chew, D. M.; Daugeras, B. Y.; Fretter, W. B.; Goldhaber, G.; Graves, W. R.; Johnson, A. D.; Kadyk, J. A.; Stutte, L. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Phys. Lett., B; 56: No. 1, 101-104(31 Mar 1975).

The inclusive ρ^0 production cross section has been measured in the reaction $\pi^-p \to \pi^+\pi^-X$ at 205 GeV/c. It is found that $\sigma(\rho^0) = 13.5 \pm 3.4$ mb, with most of the production occurring in the central region. Assuming $\sigma(\rho^+) \approx \sigma(\rho^-) \approx \sigma(\rho^0)$, it is concluded that approximately one-third of the pions at this energy come from ρ-decay. (auth)

12591 A_2^- PRODUCTION IN π^-p INTERACTIONS AT 3.9 GeV/c. Losty, M. J.; Chaloupka, V.; Montanet, L.; Paul, E.; Yaffe, D.; Zieminski, A. (European Organization for Nuclear Research, Geneva (Switzerland)); Gandois, B.; Alitti, J.; Louie, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 – Gif-sur-Yvette (France). Dept. de Physique des Particules Elementaires). Phys. Lett., B; 56: No. 1, 96-100(31 Mar 1975).

The reaction $\pi^-p \to A_2^-p$ at 3.9 GeV/c incident momentum is studied using data corresponding to the $\rho^0\pi^-$, $\eta\pi^-$, and $K_S^0K^-$ decay modes of the A_2^-. Unnatural parity exchange is found to be important at this energy. The natural parity exchange component of the differential cross section exhibits structure at $t' \approx 1$ GeV^2. (auth)

12592 STUDY OF MULTI-GAMMA FINAL STATES FROM π^-p INTERACTIONS AT 40 GeV/c with invariant mass above 2 GeV. Apel, W. D.; Augenstein, K.; Krueger, M.; Mueller, H.; Schneider, H.; Sigurdsson, G. (Karlsruhe Univ. (TH) (F. R. Germany). Inst. fuer Experimentelle Kernphysik); Bertolucci, E.; Mannelli, I.; Pierazzini, G. M.; Quaglia, M. Phys. Lett., B; 56: No. 2, 190-192(14 Apr 1975).

Searching for new heavy particles, the invariant mass spectra of neutral final states from π^-p interactions at 40 GeV/c incident momentum have been investigated. No particles, in the mass region from 2 to 5 GeV, decaying in γ-rays, π^0, η and X^0 mesons, have been found to a level of about 10^{-34} cm^2. (auth)

12593 NEW DATA ON THE REACTION $K^-p \to \Lambda\pi^0$ FROM 1.934 TO 2.516 GeV/c AND PARTIAL-WAVE ANALYSIS FOR THIS REACTION BETWEEN 2070 MeV AND 2436 MeV CMS ENERGY. de Bellefon, A.; Berthon, A.; Brunet, J.; Tristram, G.; Vrana, J. (College de France, 75- Paris); Poulard, G.; Revel, D.; Tallini, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91- Gif-sur-Yvette (France). Dept. de Physique des Particules Elementaires). Nucl. Phys., B; 90: No. 1, 1-19 (5 May 1975).

The results of a formation experiment are presented for the reaction $K^-p \to \Lambda\pi^0$ in the cms energy between 2200 and 2436 MeV with a total statistics of 10 ev/μb. A partial-wave analysis including these new data gives evidence for the existence of three resonances in the P_3, D_5 and G_9 (or H_{11}) states in this mass region. (auth)

12594 NEUTRAL K, Λ AND ANTI Λ PRODUCTION IN K^-p AND K^+p INTERACTIONS AT 32 GeV/c. Beilliere, P. (College de France, 75- Paris); Cochet, C.; Faccini, M. L.; Mosca, L.; Smadja, G.; Triantis, F. A. (CEA Centre d'Etudes Nucleaires de Saclay, 91- Gif-sur-Yvette (France). Dept. de Physique des Particules Elementaires); Dumont, J. J. (Institut Interuniversitaire des Sciences Nucleaires, Brussels (Belgium)); Miller, D. B. (Imperial Coll. of Science and Technology, London (UK). Dept. of Physics); Fenjuk, A. B.; Kozlovsky, E. A. Nucl. Phys., B; 90: No. 1, 20-34(5 May 1975).

Inclusive cross sections and one-particle inclusive spectra are given for neutral K, Λ and $\bar{\Lambda}$ produced in K^-p and K^+p interactions at 32 GeV/c in the 4.5 m Mirabelle hydrogen bubble chamber at the Serpukhov accelerator. Cross sections for associated production are also given, and the energy dependences of the cross sections and of the x distributions in the central and in the fragmentation regions are discussed. (auth)

Particle Interactions and Properties (Theoretical)

12595 DETERMINATION OF IONIZATION POTENTIALS AND ELECTRON AFFINITIES OF CERTAIN ELEMENTS BY EXTRAPOLATION. Kamenev, A. G.; Zandberg, E. Ya.; Paleev, V. I. (Ioffe Inst. of Physics and Tech., Leningrad). Sov. Phys.-Tech. Phys. (Engl. Transl.); 19: No. 7, 940-941(Jan 1975).

Translated from Zh. Tekh. Fiz; 44: No. 7, 1507-1510(Jul 1974).

Changes in the ionization potentials of elements in subgroups of the periodic table are proportional to changes in the next ionization potentials of adjacent elements of different subgroups because of the identical structure of the outer electronic shells. The proportionality factors differ, depending on the subgroups involved. This regularity is observed for elements beginning in the third row of the periodic table, provided that the outer electronic shell is filled in a regular manner in the transition of an atom of one subgroup to a neighboring atom of a different subgroup. Extrapolation on the basis of these regularities yields the following values (in volts): the first ionization potential V_1 for Fr (3.95); the second ionization potentials V_2 for Po(13.2), At(17.0) and Rn(18); and the electron affinities S of Rb(0.49), Cs(0.48), Fr(0.48), P(0.3), As(0.6), Te (1.96), Po(1.90), and At(2.90). The values of S(P) and S(As) are subsequently refined on the basis of the more accurate experimental determination of the values of S for reference elements in this subgroup. (auth)

General

Refer also to abstract 12568.

12596 (RL-75-009) PROCEEDINGS OF THE 1974 SCHOOL FOR YOUNG HIGH ENERGY PHYSICISTS, CHILTON, ENGLAND, SEPTEMBER 9–27, 1974. Muirhead, H. (ed.). (Science Research Council, Chilton (UK). Rutherford Lab.). 1975. 371p.

Nine lectures were given, in sessions entitled: basic material; scattering theory; hadron dynamics at high energies; electromagnetic interactions of hadrons; weak interactions; growing mammalian embryos in culture; pulsars and quasars. All the lectures, except the one on growing mammalian embryos in culture, were in NSA scope, and separate abstracts were prepared for them. (UK)

For abstracts of individual papers see: 12302, 12597, 12616, 12639, 12647, 12694, 12705, and 12924.

12597 (RL-75-009, pp I.1-I.47) INTRODUCTION TO THE KINEMATICS OF PARTICLE REACTIONS. Jones, G. T. (Univ. of Birmingham, Eng.). 1975.

In proceedings of the 1974 school for young high energy physicists.

The lecture covers Fermi's golden rule; elastic scattering in potential theory; normalization of plane wave states; cross section for a general reaction; Lorentz invariant phase space; the symmetric triangle function; two body phase space; recurrence relations for phase space; kinematical plots; kinematical reflections; to minimize reflections look in more dimensions at once; kinematics of two body reactions. (UK)

12598 (RL-75-047) SUPPRESSION FACTORS IN CHARMED PARTICLE PRODUCTION. Barger, V.; Phillips, J. N. (Science Research Council, Chilton (UK). Rutherford Lab.; Wisconsin Univ., Madison (USA). Dept. of Physics). Mar 1975. 15p. Dep. NTIS (US Sales Only) $4.00.

Quantitative estimates are presented for the production of particles with nonzero charm number, based on the close dynamical similarity with associated production of strange particles. It is found that cross sections may be realized at the level of 1 nb for two-body reactions and 60-nb for inclusive reactions in the triple-Regge region. Crucial elements in the calculations are the negative intercepts of the charmed Regge trajectories, and kinematic suppression through the t_{min} cutoff. (auth)

12599 HIGH ENERGY PHYSICS INDEX. Volume 13, No. 7, 1975. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1975). 100p.

12600 PARTICLE PHYSICS. Spring Conference of the German Society of Physics, Munich, Germany, March 5–7, 1975. Verhandlungen der Deutschen Physikalischen Gesellschaft, No. 7. Weinheim, Ger.; Physik Verlag GmbH (1975). 32p. (In German and English). (CONF-750327-(Absts.)).

Abstracts of the papers presented at the Conference are compiled. Topics discussed are strong interactions, electron and photoproduction, weak interactions and field theory, and experimental methods. (JSR)

12601 DECAY DISTRIBUTION OF SPIN-3/2 PARTICLES. Song, H. S. J. Korean Phys. Soc.; 7: No. 1, 1-7; 12(1974).

The projection operator $u_\mu u_\nu$ of the Rarita–Schwinger spinor of a spin-$\frac{3}{2}$ particle when its spin states are not summed is used to obtain the decay distribution of a spin-$\frac{3}{2}$ particle which decays into the spin-$\frac{1}{2}$ and spin-0 particles. The density matrix method is used in order to obtain the angular distribution and polarization distributions of the outgoing spin-$\frac{1}{2}$ particle in the rest frame of the spin-$\frac{3}{2}$ particle. The parity conserving and parity nonconserving production and decay processes are considered in the Gottfried-Jackson frame and in the coordinate system where the z axis is chosen along the production normal. (auth)

12602 SYMMETRY CONSTRAINTS ON INCLUSIVE REACTIONS IN THE FRAGMENTATION REGION. Leroy, C.; Van Parijs, J. (Univ. Catholique de Louvain, Belg.). Ann. Soc. Sci. Brux. Ser. I; 89: No. 1, 63-68(20 Mar 1975).

Mueller's theorem supplemented by factorization and SU(3) symmetry at the vertices $\pi\pi$ and $K\bar{K}$, is used to study the target fragmentation region of the inclusive reactions $a + b \to \pi + X$, $a + b \to \pi + \pi + X$. Relations among the inclusive cross sections

of $\pi + b \rightarrow c + X$ and $K + b \rightarrow c + X$ and of $\pi + b \rightarrow \pi + \pi + X$ and $K + b \rightarrow \pi + \pi + X$ are derived (b = p, n or d). (auth)

12603 CHARMING. CERN Cour.; 15: No. 4, 103-109(Apr 1975).

The review of charm covers the neutral current route to charm, proliferation of quarks, the significance of the new particle discoveries, the Layman's guide to finding charmed particles, and the experimental results so far. (JFP)

12604 ENERGY DEPENDENCE OF TOPOLOGICAL CROSS-SECTIONS AT NAL ENERGIES. Gandsman, J. (Paris-11 Univ., 91 – Orsay (France)). Phys. Lett., B; 56: No. 3, 286-290(28 Apr 1975).

The normalized cross sections $\sigma^* = \sigma' FLUX/LIPS$ are calculated using recent data on topological cross sections. The power law behavior $\sigma^* = AP_{lab}^{-n}$ is confirmed for energies up to 400 GeV. The exponent n appears to satisfy, approximately, the relation $n \approx m - 2$ for multiplicities m up to 20. (auth)

12605 SINGLE TABLE REPRESENTATION OF VARIOUS MASS FORMULAS OF ELEMENTARY PARTICLES. Bhattacherjee, B. J. (St. Anthony's Coll., Meghalaya, India). Indian J. Phys.; 48: No. 12, 1075-1079(Dec 1974).

It was shown that the elementary particles can be classified into different groups and periods according to their properties like mass, spin, parity, strangeness, isospin, and hypercharge. Such classification reveals that the Gell Mann-Okubo mass formula and Swart's spacing rule also hold for a few other groups of particles. The determination of spin and parity for normal and abnormal particles is indicated. (auth)

12606 HIGH ENERGY PHYSICS INDEX. Volume 13, No. 7, 1975. Leopoldshafen, Ger.; Zentralstelle Fuer Atomkernenergie-Dokumentation (1975). 118p.

12607 CONTEMPORARY STATE OF ELEMENTARY-PARTICLE PHYSICS. Niederle, J. Pokroky Mat. Fyz. Astrn.; 19: No. 2, 75-85(1974). (In Czech).

Unexpected changes in high energy physics are reviewed. The discipline is no longer restricted to the discovery of the secrets of nature and the development of a new cosmological concept but is involved in potential applications. Many techniques of particle physics and high energy physics are already in use for studying biological structures and solid-state and molecular physics and in various fields of chemistry. Accelerated-particle beams are used in treating malignant tumors, for conserving food, and for genetically modifying agriculturally important plants. It is possible that electron beams may be used for digging tunnels. The techniques of elementary-particle physics are also widely used in astrophysics and cosmology. Application of cryogenics is expected to revolutionize the design of computers. Investment in high energy and particle physics will be recovered by the development of new materials. (14 references). (TTT)

12608 COQUARKS. Krolikowski, W. (Trier-Kaiserslautern Univ., Kaiserslautern, Ger.). Nuovo Cim., A; 26A: No. 2, 126-132(21 Mar 1975).

Properties of the electromagnetically and weakly inactive partons are considered whose existence was suggested by deep inelastic lepton scattering. These partons are not necessarily identical with hypothetic gauge mesons. They are called "coquarks", reserving the term "gluons" for the gauge mesons. Some model-dependent arguments are presented, suggesting that the role played by coquarks in strong interactions may be analyzed by means of the average multiplicity of hadron production in pp collisions at high energies. (auth)

12609 GROSS FEATURES OF PIONIZATION AND FRAGMENTATION. Jabs, A. (Trier-Kaiserslautern Univ., Kaiserslautern, Ger.). Nuovo Cim., A; 26A: No. 2, 133-162(21 Mar 1975).

The hypothesis that multiple-particle production proceeds via two different processes called pionization and fragmentation. These two processes are specified and then plot the inclusive single-particle production spectra EdN/d^3p in the c.m. variables $x = 2p_l/\sqrt{s}$ and $y = tgh^{-1}(p_l/E)$. It is shown that the curves are consistent with CERN ISR data where such exist. By extrapolation to regions where so far no sufficient data are presented a pionization (double) peak is predicted at $x = y = 0$ and a dip or shoulder in the transition region from pionization to fragmentation at some intermediate value of $|x|$ and $|y|$. (auth)

12610 COMMUTATION PROPERTIES OF NORMAL-MODE OPERATORS AND VERTICES IN THE THEORY OF THE RELATIVISTIC QUANTUM STRING. Rebbi, C. (Univ., Sao Paulo, Brazil). Nuovo Cim., A; 26A: No. 2, 105-116(21 Mar 1975).

The commutation properties of the creation and annihilation operators of the theory of the relativistic quantum string with the vertex of interaction that describes the splitting and joining of strings in the transverse gauge are studied. As a result of the change of boundary conditions, annihilation operators acting on the vertex are partially transmitted through the vertex and partially reflected as creation operators. A compact formalism is established to describe this effect, and an application is made to study the singularities of the string operators at the point of splitting. The results of this approach are compared with the previous results obtained on the three-string interaction vertex. (auth)

Electromagnetic

Refer also to abstracts 12560, 12710, 12986, and 13005.

12611 (KHFTI-74-26) $eN \rightarrow e'N'\pi$ PROCESSES: DETECTION OF ONE OF THE FINAL HADRONS. Omelaenko, A. S. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1974. 25p. (In Russian). INIS.

Calculations were made of ratios of the differential cross section for reactions of the electro- and photoformation of singular π-mesons under experimental conditions in which only the pion that is formed is recorded. (SJR)

12612 (KIYI-74-25) ON DETERMINATION OF THE CRITICAL ENERGY IN CASCADE THEORY. Sikora, D. I.; Shabalina, L. A.; Shkoda-Ul'yanov, V. A. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1974. 11p. (In Russian). INIS.

An analysis is carried out of the experimental and theoretical data on integral spectra of electrons and photons in infinite media. By comparing the equilibrium spectrum with spectra calculated by the Monte Carlo method and also with experimental data it is shown that it is necessary to include also the energy losses for radiation in the critical energy. (SJR)

12613 (ORO-3992-202) SUM RULES FOR SINGLE PION ELECTROPRODUCTION FROM LIGHT CONE COMMUTATION RELATIONS. Dicus, D. A. (Texas Univ., Austin (USA). Center for Particle Theory). 1973. 30p. (CPT-246). Dep. NTIS $4.50.

Light-cone current commutation relations are used to derive fixed mass sum rules on the amplitudes for the electroproduction of single pions. These sum rules should provide a more direct test of the structure of the commutation relations than the sum rules previously derived. (auth)

12614 (ORO-3992-204) ON-MASS-SHELL CURRENT ALGEBRA AND THE pi^0 yields 2 gamma DECAY AND PARTIAL CONSERVATION OF AXIAL-VECTOR CURRENT ANOMALY. Golestaneh, A. A. (Texas Univ., Austin (USA). Center for Particle Theory). 1974. Contract AT(40-1)-3992. 21p. (CPT-248). Dep. NTIS $4.25.

Using the algebra of the axial vector current which is defined as a source for the pion field, the pi^0 yields decay rate and the Adler anomaly are studied. The treatment is identical with the one previously applied to the other interactions which are mentioned. It consists of expressing the reduction formula in terms of the above current and evaluating it directly on the mass-shell. In the process, one has a set of intermediate states from which the one and two-mesons states are chosen. The 3pi continuum is taken into account, effectively by a pion isobar. Hence the pi^0 amplitude is expressed in terms of the parameters of the rho, omega, phi and pi' and a coefficient beta which represents the momentum dependence of the coupling constants of these mesons, at the pi gamma vertex. A feature of the method is that it does not explicitly depend on the anomaly operator. However, by writing the current in terms of the modified PCAC operator, the pi^0 lifetime is linked with the anomaly, via these meson data and two unknown parameters, in addition the beta, which represents the pi contributions in the lifetime and the chiral symmetry breaking terms underlying the PCAC relation. The most economical combinations of these parameters are given for obtaining the observed pi^0 lifetime in accord with the anomaly given by either of the existing quark theoretical models. It is found that, unlike in the PCAC application, one can reach this objective by a current approach without the need for the pi field in the chiral symmetry breaking terms. (auth)

12615 (ORO-3992-220) MODEL-INDEPENDENT STUDY OF LIGHT CONE CURRENT COMMUTATORS. Gautam, S. R.; Dicus, D. A. (Texas Univ., Austin (USA). Center for Particle Theory). 1974. Contract AT(40-1)-3992. 16p. Dep. NTIS $4.00.

An attempt is made to extract information on the nature of light cone current commutators (L. C. C.) in a model independent manner. Using simple assumptions on the validity of the DGS representation for the structure functions of deep inelastic scattering and using the Bjorken-Johnston-Low theorem it is shown that in principle the L. C. C. may be constructed knowing the

experimental electron–proton scattering data. On the other hand the scaling behavior of the structure functions is utilized to study the consistency of a vanishing value for various L. C. C. under mild assumptions on the behavior of the DGS spectral moments. (auth)

12616 (RL-75-009, pp IV.1-IV.57) ELECTROMAGNETIC INTERACTIONS OF HADRONS: AN ELEMENTARY INTRODUCTION. Shaw, G. (Univ. of Manchester, Eng.). 1975.

In proceedings of the 1974 school for young high energy physicists.

The lecture deals with: photons, real and virtual (electroproduction, electron positron annihilation); photoproduction and vector dominance; elastic electron scattering–form factors (phase space factors, elastic scattering from a proton with structure, determination of $G_{E,M}$); inelastic electron scattering; problems with the quark parton model. (UK)

12617 NEW HADRONIC DEGREE OF FREEDOM, e^+e^- ANNIHILATION AND DEEP INELASTIC SCATTERING. Schildknecht, D.; Steiner, F. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Phys. Lett., B; 56: No. 1, 36-40 (31 Mar 1975).

Conjecturing "new duality" for e^+e^- into hadrons of a new degree of freedom, it is shown that presently known information on the particles at 3.105 and 3.7 GeV is compatible with $R \sim 4$. Scaling violations expected in deep inelastic scattering are related to the properties of $\psi(3105)$. (auth)

12618 FIELD THEORETIC MODEL FOR THE PION FORM FACTOR. Gutbrod, F.; Weiss, U. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Nucl. Phys., B; 90: No. 1, 52-76(5 May 1975).

The formalism of a field theoretic many-channel model for the electromagnetic form factors of the $\pi\pi$, the $K\bar{K}$ and the $\pi\omega$ system is presented. The main attractive force, which generates the ρ-meson, is derived from the nucleon box diagram with phenomenological strong vertex corrections. Propagator self-energy corrections are derived from the Ward identity. Long range forces are introduced through the pion exchange coupling between the $\pi\pi$ and $\rho\epsilon$ channel. The photon is coupled minimally to pions, kaons and nucleons, with subtractions performed at large spacelike momenta. The model is solved in the framework of the Bethe–Salpeter equation. Three different versions are considered which lead to slightly different pion form factors. The version giving the best $\pi\pi$ phase agrees best with the data in the spacelike region. (auth)

12619 THE CALCULATION OF X-RAY TRANSITION RADIATION GENERATED IN REGULAR- AND IRREGULAR-LAYERED MEDIA. Garibian, G. M.; Gevorgian, L. A.; Yang, C. (AN Armyanskoj SSR, Erevan. Inst. Fiziki). Nucl. Instrum. Methods; 125: No. 1, 133-137(15 Mar 1975).

Formulae for the X-ray transition radiation produced in an irregular stack of plates are obtained and presented in a form convenient for numerical calculation; absorption is taken into account. The transition radiation generated in a regular stack is also considered. For the last case a procedure for calculation of the radiation frequency spectrum depending on the stack parameters and the particle Lorentz factor is given. (auth)

12620 ELECTRON–POSITRON ANNIHILATION AND HIGH-ENERGY BEHAVIOUR OF WEAK INTERACTIONS. Kabir, P. K. (Sussex Univ., Brighton (UK). School of Mathematical and Physical Sciences); Karl, G. (Guelph Univ., Ontario (Canada). Dept. of Physics). Nucl. Phys., B; 90: No. 1, 125-130(5 May 1975).

As a consequence of the proportional vector current hypothesis connecting weak and electromagnetic interactions, hadronic final states are expected to predominate in $\bar{\nu}_e e$ reactions in the energy range $3\ \text{GeV} < E_{cm} < 5\ \text{GeV}$. A unitarity bound is derived relating the cross section for hadron production in $\bar{\nu}_e e$ collisions to that for $\bar{\nu}_\mu \mu^-$ production. If the observed cross section for $\bar{e}e$ annihilation in the range 3-5 GeV is extrapolated to higher energies, both $\bar{e}e$ and $\bar{\nu}_e e$ cross sections are found to reach their similar unitarity bounds at c.m. energies between 40-50 GeV. (auth)

12621 ON THE PROCESS $eZ \rightarrow Z\mu$ ANTI $\nu_\mu\ \nu_e$. Dittrich, J. (Ustav Jaderne Fyziky, Rez (Czechoslovakia)). Nucl. Phys., B; 90: No. 1, 35-44(5 May 1975).

The total cross section for the process $eZ \rightarrow Z\mu\ \bar{\nu}_\mu \nu e$ in the energy range from 1 to 150 GeV and for a set of nuclei is calculated within the framework of the conventional V-A theory of weak interactions. (auth)

12622 LEADING CONFORMAL CONTRIBUTION TO THE ELECTROMAGNETIC FORM FACTOR. Menotti, P. (Scuola Normale Superiore, Pisa (Italy)). Phys. Lett., B; 56: No. 2, 169-172(14 Apr 1975).

It is proven that the leading γ_5-even conformal light-cone contribution to the vertex function of a scalar (pseudo-scalar) composite particle of the fermion-antifermion channel, gives an asymptotic contribution to the electromagnetic form factor in the triangle approximation, $(-q^2)^{1-\bar{d}}$, $\bar{d}$ being the dimension of the composite field. (auth)

12623 THEORY OF SYNCHROTRON RADIATION BY A CHARGED, CURRENT-CARRYING RING. Kukanov, A. V.; Lavrova, G. A. (Moscow State Univ.). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 12, 84-89(1974). (In Russian).

The problem of synchrotron radiation by a charged, current-carrying ring is considered. An expression taking into account polarization effects was found for the spectral-angular distribution of radiation intensity. Partial cases of the general formula are considered: a boundary transition to the generalized formula of Schott, a formula for the intensity of synchrotron radiation by a magnetic dipole oriented tangentially to the trajectory of motion, and also on the basis of a method of multiplying Bessel functions a transition to formulas for the intensity of Cherenkov radiation by a charged, current-carrying, ring bundle. (SJR)

12624 ELECTROMAGNETIC RADIATION OF A PARTICLE IN KERR AND SCHWARZSCHILD FIELDS. Ternov, I. M.; Khalilov, V. R.; Chizhov, G. A. (Moscow State Univ.). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 12, 42-52(1974). (In Russian).

A detailed analysis is given of the properties of the electromagnetic radiation of a charged particle moving along a curved, geodesic trajectory in the equatorial plane of a Kerr gravitational field. Formulas are obtained characterizing the spectral-angular, angular and spectral distribution of the radiation that occurs. Studies were made of cases of nonrelativistic and relativistic velocities of the emitting charge. A look is taken at the problem of amplification of the radiation of the charge by rotational collapse. At defined values of the parameters the results are applicable in describing the radiation of a charge in a Schwarzschild field. (SJR)

12625 DEVELOPING THE THEORY OF A LUMINESCENT ELECTRON. Sokolov, A. A.; Borisov, A. V.; Gal'tsev, D. V.; Zhukovskii, V. Ch. (Moscow State Univ.). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 12, 5-18(1974). (In Russian).

A short review is given of studies on the theory of synchrotron emission, and also studies of a number of quantum effects accompanying the motion of electrons in a magnetic field. A presentation is given of the quantum derivation of formulas describing the behavior of the amplitudes of the radial and axial oscillations of an electron moving in a nonhomogeneous magnetic field of the weakly focusing type. A look is taken at the behavior of electron spin with oscillations in a nonhomogeneous field (self-polarization effect) being taken into account. A quantum interpretation is given of spin, depolarizing resonances in accumulators. (SJR)

12626 EFFECT OF THE NONUNIVERSALITY OF THE RATIO g/e ON THE SPECTRUM OF A HYDROGEN-LIKE SYSTEM AND EVALUATION OF THE MAGNETIC CHARGE. Biza, Yu. S.; Tomil'chik, L. M. (Inst. of Physics, Minsk). Vestsi Akad. Navuk BSSR, Ser. Fiz.-Mat. Navuk; No. 2, 110-113(1975). (In Russian).

Using the activation theory to a first approximation, the effect of deviations of g/e values from the universal value on the energy spectrum of a nonrelativistic hydrogen-like system consisting of two doubly charged particles was calculated, and the values of the magnetic charge on the proton, muon, pion, and kaon were evaluated numerically from spectroscopy data for the hydrogen atom and mesoatoms. (tr-auth)

12627 POSSIBILITY OF THEORY OF MAGNETIC CHARGE WITHOUT CHARGE QUANTIZATION CONDITIONS. Strazhev, V. I.; Tomil'chik, L. M. (Inst. of Physics, Minsk). Vestsi Akad. Navuk BSSR, Ser. Fiz.-Mat. Navuk; No. 2, 51-58(1975). (In Russian).

The critical role of charge quantization conditions in calibration-invariant electrodynamics was analyzed with two types of sources. It was shown that there are at present neither experimental nor theoretical bases for schemes which do not consider the charge-quantization conditions. (tr-auth)

12628 ANGULAR DISTRIBUTIONS OF ELECTRONS SCATTERED ON THREE-NUCLEON NUCLEI AND SPLITTING THESE NUCLEI INTO A NUCLEON AND DEUTERON. Tartakovskii, V. K.; Kozlovskii, I. V.; Fursa, A. D. (Kiev State Univ.). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 1, 107-111(1975). (In Russian).

Angular distributions of electrons are obtained during inelastic scattering on the nuclei ^3He and ^3H, which is accompanied by two-particle splitting of the nuclei, with the interaction between the nucleon and deuteron which are formed being taken into account, and without this interaction being taken into account. The interaction in the final state has a strong effect on the calculated dependencies, and its consideration improves the agreement of the calculated cross sections with the experimental values of the cross sections. (SJR)

12629 THEORY OF FORMING A PAIR AND A PHOTON BY A PHOTON IN THE FIELD OF A NUCLEUS. Smirnov, A. I. Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 1, 130-131(1975). (In Russian).

The above reaction is considered for unpolarized particles, when the emitted gamma quantum radiates in the direction of the primary gamma quantum, and the electron and positron have simultaneous 4-momenta. The differential cross section of this reaction is calculated by a well known method of Feynman. It is shown that previous estimates published in the literature for the cross section of this reaction are low by an order of magnitude. (SJR)

12630 ELECTRON IN THE FIELD OF TWO CLASSICAL PLANE WAVES DIRECTED TO EACH OTHER AT A SMALL ANGLE. Bagrov, V. G.; Gitman, D. M.; Zadorozhnyi, V. N.; Shvartsman, Sh. M. (Tomsk State Univ., USSR). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 1, 42-45(1975). (In Russian).

Solution of the equations of Dirac and Klein-Gordon are obtained for an electron moving in a field of two plane waves propagating at a small angle to each other. The solutions are obtained in the form of decompositions according to the small angle. Terms which are linear according to angle are taken into account. (SJR)

12631 SPIN-ORBIT COUPLING. Beck, G.; Davidovich, N. (Centro Atomico, Bariloche, Argentina). Nuovo Cim.; 27B: No. 1, 19-26(11 May 1975).

It is shown that the well known spin-orbit interaction term contained in Dirac's theory of the electron is, in the relativistic approximation, a pure quantum phenomenon and cannot be derived from relativistic point mechanics. (auth)

12632 ANTI-COMPTON SCATTERING. Synge, J. L. (Dublin Inst. for Advanced Studies). Proc. R. Irish Acad., Sect. A.; 74A: No. 9, 67-72(1974).

The purpose is to answer the following question in terms of the concepts of classical relativistic mechanics: How is Compton scattering altered if the photon is replaced by a particle of zero rest mass and negative energy, and the conservation of 4-momentum is applied? It turns out that there are three types of scattering, and in two of these there are forbidden cones into which the massive particle cannot be scattered. Since particles with negative energies are not accepted in modern physics, it is perhaps best to regard this work as a kinematical exercise in Minkowskian geometry, worth recording because the results are not obvious. (auth)

12633 AN ANALOGUE OF THE KAPITZA-DIRAC EFFECT. Haroutunian, V. M.; Avetissian, H. K. (Erevanskij Gosudarstvennyj Univ. (USSR)). Phys. Lett., A; 51: No. 6, 320-322(7 Apr 1975).

This paper concerns the quantum motion of a relativistic electron in the field of opposite electromagnetic waves of different frequencies. An effect has been found that is similar to the Kapitza-Dirac effect. However, as distinguished from the latter, scattering here is inelastic; due to the coherent transition from one wave to the other of photons of different frequencies, the electron is either accelerated or decelerated. In this case, amplification of the wave of the lower or of the higher frequency takes place, respectively. (auth)

12634 NONRELATIVISTIC CLASSICAL AND QUANTUM SCATTERING BY A DIPOLE AND BY A NEUTRAL SYSTEM OF TWO FIXED CHARGES. Alvarez-Estrada, R. F.; Villalon, M. E. (Junta de Energia Nuclear, Madrid). Nuovo Cim., 27B: No. 1, 79-93(11 May 1975).

The interaction and scattering of a nonrelativistic charged particle by the potentials due to a dipole and two fixed charges of equal magnitude and opposite signs are investigated both in classical and quantum mechanics. The classical and quantum differential cross sections are studied theoretically. In the dipole case, "falls to the origin" are shown to be absent in certain conditions. The quantum bound states in the two-charge case are studied through the WJKB method. (auth)

12635 HADRONIC ANGULAR DISTRIBUTION IN (e^+e^-) PROCESSES FROM 1.2 TO 3.0 GeV. Bernardini, M.; Bollini, D.; Brunini, P. L.; Fiorentino, E.; Massam, T.; Monari, L.; Palmonari, F.; Rimondi, F.; Zichichi, A. (CERN, Geneva). Nuovo Cim., A; 26A: No. 2, 163-168(21 Mar 1975).

The angular distribution of 2720 tracks of 1085 hadronic final states produced from (e^+e^-) annihilation was studied in the 1.2 to 3.0 GeV total center-of-mass energy range. If one parametrizes the angular distribution in terms of $I(\theta) = 1 + A\cos^2\theta$, where θ is the angle between the hadronic track produced and the colliding-beam direction, the results show that A is less than 0.21, with 90% confidence. (auth)

12636 ESCAPE OF PHOTONS FROM CHARGED BODIES. Krori, K. D.; Barua, J. (Cotton Coll., Gouhati, India). Proc. Indian Acad. Sci., Sect. A; 81: No. 1, 9-14(Jan 1975).

It is shown that the restriction of photons issuing from the surface of an uncharged sphere with Schwarzschild radius to the radial direction is removed for a charged sphere. Also it is established that in the case of a charged infinitely long cylinder the mass per unit length does not impose any restriction on the photons issuing from the surface in nonradial directions unlike in the case of uncharged infinitely long cylinders. But in the limit when the radius of the charged cylinder approaches a certain value depending on the mass per unit length and the charge per unit length, only the radially moving photons may escape. (auth)

12637 SQUARE WELL MODEL AND THE FUNCTIONAL FORM FOR THE RESONANCE INTEGRAL. Raina, V.; Srivastava, P. K.; Sane, K. V. (Univ. of Delhi). Int. J. Quant. Chem.; 9: No. 2, 379-381(Mar 1975).

It is shown that the relation beta equals eta(Z_1Z_2)/sup 1/2/ exp/broken bracket/ -X$(Z_1 + Z_2)$R/broken bracket//R can be derived by assuming that the effective potential in pi-electron systems can be approximated by a three-dimensional square well form. (JFP)

Weak

12638 (ORO-3992-168) RENORMALIZABLE THEORY OF LEPTONS WITH INTRINSIC SYMMETRY BREAKDOWN. Hsu, J. P.; Sudarshan, E. C. G. (Texas Univ., Austin (USA). Center for Particle Theory). 1974. 13p. (CPT-212). Dep. NTIS $4.00.

A manifestly "renormalizable" unified theory of weak and electromagnetic interactions for leptons with intrinsic symmetry breakdown is described. Unitarity and gauge-independence of the physical S-matrix are verified up to and including the two-loop level. The theoretical and experimental implications of the theory are discussed. (auth)

12639 (RL-75-009, pp V.1-V.78) WEAK INTERACTIONS. Myatt, G. (Oxford Univ.). 1975.

In proceedings of the 1974 school for young high energy physicists.

The lecture deals with: nuclear β-decay and the origins of the V-A theory, projection operators, evaluation of matrix elements, Fierz interference terms, parity violation, longitudinal polarization of electrons from β-decay, helicity of the neutrino, helicity of electrons, β-decay of polarized neutrons, application of the current-current theory to other processes, the intermediate vector boson hypothesis, pion decay, structure factors, conserved vector current theory, induced pseudoscalar coupling, Cabibbo theory, SU(3), weak currents, decay rates, pseudoscalar meson decays, inclusive neutrino reactions, parton model, gauge theories and neutral currents, gauge invariance, Yang-Mills theory, spontaneous symmetry breaking, incorporation of hadrons. (UK)

12640 THE LONG RANGE PART OF THE PARITY-VIOLATING ELECTRON FORM FACTOR IN THE WEINBERG-SALAM MODEL. Noelle, J.; Reid, J. H. (Bochum Univ. (F. R. Germany)); Schuelke, L. (Abteilung fuer Physik, Gesamthochschule Siegen, F. R. Germany). Phys. Lett., B; 56: No. 1, 57-60(31 Mar 1975).

The long-range part of the parity-violating electron muon interaction is calculated in fourth order in the Weinberg-Salam model. Independent of the non-abelian gauge, a range of about 50 fm is found. Possible applications are suggested. (auth)

12641 RARE DECAY MODES OF THE K MESONS AND $K_L - K_S$ MASS DIFFERENCE IN AN ASYMPTOTICALLY FREE GAUGE THEORY. Nanopoulos, D. V.; Ross, G. G. (European Organization for Nuclear Research, Geneva (Switzerland)). Phys. Lett., B; 56: No. 3, 279-285(28 Apr 1975).

Rare decay modes of the K mesons are calculated for the Weinberg-Salam model of weak and electromagnetic interactions, assuming that the strong interactions are described by an asymptotically free gauge theory. (auth)

12642 NONLINEAR SPINOR THEORY AND THE MODEL OF WEINBERG. Nguen Ngok Zao. (Moscow State Univ.). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 12, 134-136(1974). (In Russian).

It is shown that with the help of the formalism of removing the degeneracy of a vacuum the nonlinear, spinor lagrangian of Heizenberg-Ivanenko can be reduced to a model lagrangian of the weak, electromagnetic interaction type of Weinberg. (SJR)

12643 SEMI-LEPTONIC NEUTRAL-CURRENT DECAYS. Schechter, J.; Singer, M. (Syracuse Univ., NY). Nuovo Cim., A; 26A: No. 2, 117-125(21 Mar 1975).

The possibility of testing neutral-current models in the strangeness-conserving semi-leptonic decays is discussed. The most reasonable experiment would seem to involve a search for parity-

violating effects in $\Sigma^0 \to \Lambda e^+e^-$. However, an additional order-of-magnitude suppression for this process due to the favored value of the mixing angle in the Weinberg–Salam theory. Other weak-interaction models and different processes are also discussed. (auth)

12644 PARTIAL DIAGONALITY OF STRESS TRACE. Roy, P. (Tata Inst. of Fundamental Research, Bombay). Pramana.; 4: No. 2, 55-57(Feb 1975).

The trace of the stress energy tensor is shown to be diagonal between two states whose total four-momenta are equal. Additional comments are made on certain matrix-elements of the time-derivative of the dilation charge. (auth)

Strong (General)

12645 (ORO-3992-199) HYDRODYNAMICAL EXPANSION WITH FRAME INDEPENDENCE SYMMETRY IN HIGH ENERGY MULTIPARTICLE PRODUCTION. Chiu, C. B.; Sudarshan, E. C. G.; Wang, K. (Texas Univ., Austin (USA). Center for Particle Theory). 1974. 32p. (CPT-243). Dep. NTIS $4.75.

The space–time development of the hadronic system formed immediately after the high energy hadron collision is described with the following picture. Initially the system is highly compressed along the longitudinal direction. The sudden relaxation of this compression leads to a violent acceleration along this direction and perhaps a weak acceleration along the transverse direction. When these accelerations cease, it is proposed that the system acquires a frame independence symmetry with its further expansion governed by the hydrodynamic equation of motion. Within the scheme, this symmetry provides a natural mechanism which eventually leads to a flat inclusive longitudinal rapidity distribution and it also admits a sharp cutoff in the inclusive transverse momentum distribution. The latter is to be contrasted with the prediction of Landau's model, where the average transverse momentum increases with c.m. energy W, [p/sub T/] – W/sup 1/6/. Finally effects of clustering can also be easily incorporated within the framework. (auth)

12646 (ORO-3992-203) HYDRODYNAMICAL MODEL WITH MASSLESS CONSTITUENTS. Chiu, C. B.; Wang, K. H. (Texas Univ., Austin (USA). Center for Particle Theory). 1974. 18p. (CPT-247). Dep. NTIS $4.00.

Within the constituent hydrodynamical model, it is shown that the total number of constituents is conserved, if these constituents are massless and satisfy the Fermi-Dirac distribution. A simple scheme for the transition from the constituent-phase to the hadron-phase is suggested, and the hadron inclusive momentum spectra are presented for this case. This phase transition scheme predicts the average transverse momentum of meson resonances which is compatible with the data. (auth)

12647 (RL-75-009, pp III.1-III.45) HADRON DYNAMICS AT HIGH ENERGIES. Moorhouse, G. (Univ. of Glasgow). 1975.

In proceedings of the 1974 school for young high energy physicists.

The lecture deals with: hadron-hadron interactions, elastic scattering, inelastic scattering, S channel, T channel, U channel, Regge poles, duality, scattering amplitudes, total cross sections, Pomeranchuk theorem, quark model, parton model, inclusive reactions, optical theorem, form factors. (UK)

12648 CORRELATIONS, CLUSTERIZATION AND MPM. Perlovsky, L. I. (AN SSSR, Novosibirsk. Inst. Matematiki). Phys. Lett., B; 56: No. 1, 45-46(31 Mar 1975).

It is shown that experimental data on two-particle correlations do not contradict the large cluster size, when repulsion between the clusters is taken into account. In a cluster multiperipheral model (MPM) the effect of the repulsion between the clusters is easily estimated and the particle number in a cluster is here $n \sim 8$. (auth)

12649 PEAKS AND BACKGROUND IN THE DRELL–YAN MODEL. Eylon, Y.; Zarmi, Y. (Weizmann Inst. of Sciences, Rehovoth (Israel). Dept. of Nuclear Physics). Phys. Lett., B; 56: No. 1, 47-52(31 Mar 1975).

Starting from e^+e^- annihilation data as input, lepton pair production cross sections are calculated in hadronic collisions, using the Drell–Yan model. Taking into account resonance contributions and the experimental mass resolution it is found that the agreement with experiment is good. The model is used for estimating the production cross section of ψ resonances in hadronic collisions. (auth)

12650 BARE QUARK MASSES. Testa, M. (California Inst. of Tech., Pasadena (USA)). Phys. Lett., B; 56: No. 1, 53-56 (31 Mar 1975).

Evidence for a relativistic quark dynamics as a description of hadrons is beginning to emerge from the phenomenology of the so-called deep inelastic experiments. According to this picture the hadron currents are bilinear combinations of canonical fundamental quark fields. The naive use of equations of motion leads then to an explanation of the observed Bjorken scaling. Bare quark masses are estimated in terms of deep inelastic experimental data. The values $m_u = m_d \sim 11$ MeV and $m_s \sim 274$ MeV are obtained. (auth)

12651 DOES THE POMERON HAVE TWO COMPONENTS. Lipkin, H. J. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Nuclear Physics). Phys. Lett., B; 56: No. 1, 76-80 (31 Mar 1975).

Experimental total and differential elastic cross sections are in remarkable agreement with the ansatz that the Pomeron contribution satisfies the relation P(πp) = (1/2)P(Kp) + (1/3)P(pp) weaker than the quark model relation P(πp) = P(KP) = (2/3)P(pp) and following from the assumption that the Pomeron has a second component satisfying the relation P(πp) = 2P(KP) = (4/9)P(pp). Sum rules obtained from this ansatz are satisfied to an accuracy of 1% by total cross section data from 6 to 200 GeV/c where the quark model relation has a consistent discrepancy of 15%. They are satisfied to better than 20% for differential cross section data at 3, 3.6, 5, 6 and 42 GeV/c over a range of t where cross sections change by several orders of magnitude and the ratio of Kp and pp amplitudes varies from 2/5 to 5 and violates the simple quark model prediction of 2/3 by large factors in both directions. (auth)

12652 REMARKS ON NEW MESON STATES. Kitakado, S.; Orito, S.; Walsh, T. F. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Phys. Lett., B; 56: No. 1, 88-92(31 Mar 1975).

Some of the phenomenological consequences of the assumption that the new meson seen in e^+e^- and hadron collisions is the lowest spin one state containing a charmed quark and the corresponding antiquark are discussed. (auth)

12653 MASSIVE QUARKS AND LARGE TRANSVERSE MOMENTA. II. One-Particle Inclusive Scattering. Preparata, G. (European Organization for Nuclear Research, Geneva (Switzerland)). Nucl. Phys., B; 89: No. 3, 445-462(28 Apr 1975).

The massive quark model (MQM) is applied to one-particle inclusive cross sections at large p_T. Several different contributions are computed, all characterized by power laws $[E(d^3\sigma/d^3p)]_i \sim (1/s^{n_i})\, F_i(\omega_1, \omega_2)$, ($\omega_1 = 2pp_1/s$, $\omega_2 = 2pp_2/s$), with different "indices" n_i and scaling functions $F_i(\omega_1, \omega_2)$. One of these contributions exhibits the celebrated p_T^{-4} scaling behavior, but it appears to dominate only at very high s ($s > 10^4$ GeV^2) and for very small values of ω_1 and ω_2. For lower values of s and small $\omega_{1,2}$ a p_T^{-8} behavior for mesons and p_T^{-10} for baryons is obtained, while for larger values of $\omega_{1,2}$ it is found that the contribution with $n = 5$ dominates. A discussion of particle yields, multiplicities and structure of final states is also given. (auth)

12654 TEMPORARY QUARK CONFINEMENT IN FIELD THEORETICAL BAGS. Vinciarelli, P. (European Organization for Nuclear Research, Geneva (Switzerland)). Nucl. Phys., B; 89: No. 3, 463-492(28 Apr 1975).

The problem of confining quarks within hadronic bound states is studied in detail in the context of local relativistic field theories exhibiting spontaneous breakdown of chiral symmetry. In particular, interacting systems of scalar and spinor fields in one-space-one-time dimension and in three-space-one-time dimension with spherical symmetry are considered. For some such systems in the tree approximation bound state solutions are found. As it has been conjectured earlier, the binding mechanism and the ensuing temporary confinement of quarks are seen to be intimately related to local vacuum excitations and the local restoration of manifest chiral symmetry (which is globally hidden). Properties of the solutions are discussed and various implications are drawn on aspects of the dynamics of reactions in which such bound states could participate as in-going or out-going particles. (auth)

12655 UNIFIED FIELD THEORIES OF BAGS AND STRINGS. Vinciarelli, P. (European Organization for Nuclear Research, Geneva (Switzerland)). Nucl. Phys., B; 89: No. 3, 493-507(28 Apr 1975).

Within the models of temporary quark confinement in field theoretical bags, string-like solutions are exhibited in the tree approximation. It is argued that the bag-like and dual string-like pictures complement each other with the former describing the low-lying hadronic states and the latter the excited states of large angular momentum. When certain quantum fluctuation effects are included, Regge trajectories are found, in a certain dynamical regime, to always approach straight lines in a (J, E^2) plane. (auth)

12656 THE PROCESSES OF DIFFRACTION DISSOCIATION AT SMALL MOMENTUM TRANSFER AS A WAY OF STUDYING THE ASYMPTOTICS OF TOTAL CROSS SECTIONS. Azimov, Ya.; Khoze, V. A.; Levin, E. M.; Ryskin, M. G. (Leningrad Nuclear Physics Institute, Gatchina, 188350, USSR). Nucl. Phys., B; 89: No. 3, 508-534(28 Apr 1975).

It is shown that the energy dependence of forward diffraction dissociation enables one to distinguish experimentally between the theory with asymptotically constant total cross sections and other possibilities. In the framework of this theory, characteristic features of diffraction processes are considered and estimates are given for changes of total and forward diffraction cross sections in the available energy range under different assumptions on many-pomeron cut contributions. (auth)

12657 EXTENSION OF THE CHOU–YANG MODEL TO MULTIPARTICLE PROCESSES. Henyey, F. S.; Sukhatme, U. P. (Michigan Univ., Ann Arbor (USA). Dept. of Physics). Nucl. Phys., B; 89: No. 2, 287-306(21 Apr 1975).

A natural and essentially unique extension of the Chou–Yang model to multiparticle processes is presented. The multiparticle amplitudes are derived from the physical ideas of the original Chou–Yang approach. The beam and target particles are treated as extended, non-recoiling, Lorentz-contracted objects which interact and produce particles as they pass through each other. The resulting multiparticle amplitudes satisfy s-channel unitarity exactly. A minor modification allows us to include diffractive inelastic effects. When diffraction is included the connection with the electromagnetic form factor must be given up. The model is in good qualitative agreement with various features exhibited by the data. The model requires the total cross section to rise in a definite way. However, quantitative agreement at ISR energies is far from satisfactory. This is probably due to the no-recoil assumption inherent in the Chou–Yang model. (auth)

12658 HOW TO CUT THE POMERON. Lehman, E. S.; Winbow, G. A. Nucl. Phys., B; 89: No. 2, 307-316(21 Apr 1975).

It is shown how to make s-channel unitarity cuts through an arbitrary graph involving bare pomerons. The main result is to generalize to any diagram the conclusion that the only single particle inclusive multiperipheral production comes from single bare P intermediate t-channel states. (auth)

12659 SCALING VERSUS FIREBALL BEHAVIOUR IN DUAL RESONANCE DECAY. Andric, I.; Satz, H. (Bielefeld Univ. (F. R. Germany)); Dadic, I. (International Centre for Theoretical Physics, Trieste (Italy)). Nucl. Phys., B; 89: No. 2, 326-344 (21 Apr 1975).

The dual resonance model is used to calculate inclusive single particle distributions for the decay of a heavy cluster with fixed spin. In the statistical average, with equal weights and random phases for all degenerate states, the resulting spectrum provides, for a wide range of cluster masses and spins, a linearly exponential cut-off: the same behavior as found in the statistical bootstrap model. On the other hand, specific (high mode) degenerate states are shown to yield a scaling decay spectrum, as conjectured e.g., by parton considerations for time-like photons. Consequences for hadron-hadron interactions and for e^+e^- annihilation are discussed. (auth)

12660 CONSTITUENT QUARK ANALYSIS OF HADRONIC TRANSITIONS. Carlitz, R. (Chicago Univ., Ill. (USA). Enrico Fermi Inst.); Weyers, J. (European Organization for Nuclear Research, Geneva (Switzerland)). Phys. Lett., B; 56: No. 2, 154-158(14 Apr 1975).

Local operators may be expanded in terms of non-local constituent quarks. If, as it is argued, this expansion is rapidly convergent, a useful phenomenological scheme results. This scheme is applied to study the pionic and electromagnetic transitions of hadrons. (auth)

12661 AN SU(2) X U(1) GAUGE THEORY USING A TWO TRIPLET QUARK MODEL. Herbert, J. M. (Kent Univ., Canterbury (UK)). Phys. Lett., B; 56: No. 2, 159-160(14 Apr 1975).

An SU(2) X U(1) gauge model using two basic triplets of quarks is constructed. The model is similar to the Weinberg–Glashow, Iliopoulos, Maiani model using a basic quartet of quarks, and assigns integral charge and baryon number to the quarks. (auth)

12662 NON-VANISHING OF THE BARE TRIPLE-POMERON COUPLING FROM S-CHANNEL UNITARITY. Marchesini, G.; Veneziano, G. (European Organization for Nuclear Research, Geneva (Switzerland)). Phys. Lett., B; 56: No. 3, 271-274(28 Apr 1975).

In the crossing-symmetric Reggeon calculus based on the 1/N expansion, s-channel unitarity sum rules are written down explicitly to each order in 1/N. Some of the lowest-order sum rules are shown to imply a non-vanishing bare triple-Pomeron coupling at t = 0, irrespectively of the bare Pomeron intercept. (auth)

12663 A BROKEN SU(4) SCHEME FOR POMERON COUPLINGS AND THE DIFFRACTIVE PHOTO- AND NEUTRINO-PRODUCTION OF CHARMED VECTOR MESONS. Inami, T. (Paris-11 Univ., 91–Orsay (France). Lab. de Physique Theorique et Particules Elementaires). Phys. Lett., B; 56: No. 3, 291-296(28 Apr 1975).

Upon conjecture of the existence of f_c, the sixteenth member of the ideally mixed hexa-decimet tensor trajectories, the idea of the f and f' dominance of Pomeron coupling is extended from SU(3) to SU(4). Relations between diffractive cross-sections for processes with and without charmed particles are derived. These relations involve the intercepts of f, f' and f_c trajectories and are estimated in a model of exchange-degenerate linear ϕ_c-f_c trajectory incorporating the new particles of mass 3.1 and 3.7 GeV. The low f_c intercept leads to a strong suppression of cross-sections for ϕ_c photo-production and F* neutrino production compared to ρ production. (auth)

Strong (Baryon No. = 0)

12664 (N–74-34191) MESON PRODUCTION AS A SHOCK WAVE PROBLEM. Heisenberg, W. Translated from Z. Phys.; 133: 65-79(1952). 25p. (NASA-TT-F–15937). NTIS $4.25.

The production of many mesons in the collision of two nucleons is described as a shock wave process represented by a nonlinear wave equation. The quantum-theoretical features of the process can then be considered a high quantum number process. Statements on the energetic and angular distributions of the various types of mesons arise from the solutions of the nonlinear wave equation. (auth)

12665 (RL-75-062) PSI′ → PSI$\pi\pi$ DECAY AS A TEST OF PCAC. Morgan, D.; Pennington, M. R. (Science Research Council, Chilton (UK). Rutherford Lab.). Apr 1975. 19p. Dep. NTIS (US Sales Only) $4.00.

The shape of the $\pi^+\pi^-$ mass distribution in the recently analyzed $\psi' \to \psi\pi\pi$ decay is explained. Although the explanation assumes the known general features of the $\pi\pi$ s-wave amplitude, detailed alternatives are not distinguished; rather, it is the on-shell appearance of the Adler zero which is crucial. The extension of this description to other dipion production processes is illustrated with a discussion of low energy $\pi^-p \to \pi^+\pi^-n$. (auth)

12666 SOME REMARKS ON THE PRODUCTION AND DECAYS OF THE NARROW MASSIVE BOSONS IN THE 3 TO 4 GeV/c^2 MASS REGION. Becchi, C.; Morpurgo, G. (Genoa Univ. (Italy). Istituto di Fisica). Phys. Lett., B; 56: No. 1, 85-87(31 Mar 1975).

It is shown that an analysis of the two body hadronic decays of the recently discovered massive bosons (particularly into two pseudoscalar or two neutral vector mesons) would give information of great interest on the interactions responsible for the decays. (auth)

12667 COUPLED DISPERSIVE-UNITARY EQUATIONS FOR THE SCATTERING OF PIONS AND KAONS. Yndurain, F. J. (Universidad Autonoma de Madrid (Spain)). Nucl. Phys., B; 89: No. 2, 317-325(21 Apr 1975).

Equations are written that generalize those obtained by Roy for $\pi\pi$ scattering, for the processes $\pi\pi \to K\bar{K}$, $\pi K \to K\pi$, $\pi K \to \pi K$, $K\bar{K} \to \bar{K}K$, $K\bar{K} \to K\bar{K}$, and $KK \to KK$. These equations take into account multichannel unitarity. Particular attention is paid to the K matrix formalism, incorrectly applied in much of the existing literature. (auth)

12668 FOURTH TRIPLET QUARKS FOR PSI. Suzuki, M. (California Univ., Berkeley (USA). Dept. of Physics). Phys. Lett., B; 56: No. 2, 165-168(14 Apr 1975).

A phenomenological model is presented on the basis of experimental data on the Ψ particles. A fourth triplet of quarks with no color are added to the Han–Nambu type quarks to form three 1^- states coupled to the one photon state. (auth)

12669 A MODEL OF COLORED VECTOR MESONS. Yang, T. C. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). Phys. Lett., B; 56: No. 2, 161-164(14 Apr 1975).

A mass formula is presented for the color excitation of vector mesons. Identifying the 3105 MeV resonance as the colored ω meson, a colored ϕ meson with mass ~4.1 GeV and with its leptonic pair decay width Γ_e = 3.8 keV is predicted in good agreement with preliminary data. Ψ(3695) is suggested as the daughter of the Regge recurrence of the colored ω meson. (auth)

12670 THE BUDDING POMERON IN THE TREE APPROXIMATION TO $\pi\pi$ INELASTIC CHANNELS. Pennington, M. R. (SEE CODE-5677710 Science Research Council, Chilton (UK). Rutherford High Energy Lab.). Nucl. Phys., B; 90: No. 1, 131-145(5 May 1975).

To study how the budding pomeron is produced in meson-meson scattering the first inelastic channels to couple strongly to $\pi^+\pi^+$ are investigated. The $\pi^+\pi^+ \to p^+p^+$ and $\pi^+\pi^+ \to \pi^+A_1^+$ cross sections are calculated in the tree graph approximation—with the ratio of $A_1 \to \rho\pi$ decay rates computed on the way. It is concluded that either the pubescent pomeron is not precocious in $\pi\pi$ scattering or factorisation is not fulfilled. (auth)

12671 GRANDDAUGHTER TRAJECTORIES IN ANTIPP ANNIHILATIONS. Donnachie, A.; Thomas, P. R. (Univ. of Manchester, Eng.). Nuovo Cim., A; 26A: No. 4, 317-328(21 Apr 1975).

The differential cross section data for $\bar{p}p$ annihilations were fitted to $\pi^-\pi^+$ and K^-K^+ with a model consisting of resonances together with a constituent interchange model background. Strong evidence is found for meson resonances of mass 2.11, 2.3 and 2.48 GeV/c^2 with spins of 3, 4 and 5 respectively. Also there is weaker evidence for a J = 2 resonance near threshold. Together with the $\rho'(1600)$ these resonances form a "granddaughter" Regge trajectory approximately two units of angular momentum below the ρ-A_2 trajectory. (auth)

12672 PHENOMENOLOGY OF S AND P PION–PION PARTIAL WAVE AMPLITUDES. Deo, B. B. (Utkal Univ., Bhubaneswar, India); Mohapatra, J. K. Pramana.; 4: No. 2, 58-73(Feb 1975).

A scheme of parametrization of $\pi\pi$ S and P partial wave amplitudes is proposed. Analytic, crossing and unitarity properties are rigorously satisfied. The analyticity property is made explicit by the use of a conformally mapped variable. The expressions fit excellently with both phase shift and inelastic curves for center of mass energy up to 1-4 GeV. (auth)

12673 UNIVERSALITY OF THE P-WAVE PION COUPLING. Fiore, R. (Univ., Turin); Rossetti, C. Nuovo Cim., A; 26A: No. 3, 197-210(1 Apr 1975).

A general relation for the coupling of a p-wave pion with a generic hadronic pair is proposed in the framework of standard current algebra techniques. Calculations are done for many particular cases. The existent experimental data agree very well with the proposed relation. (auth)

Strong (Baryon No. = 1)

Refer also to abstracts 12588, 12591, and 12705.

12674 (RL-75-045) PARTIAL WAVE ANALYSIS OF THE Q REGION IN THE REACTIONS $K^-p \rightarrow K^-\pi^+\pi^-p$ AND $K^-p \rightarrow$ ANTI $K^0\pi^-\pi^0p$ AT 14.3 GeV/c. Tovey, S. N.; Hansen, J. D.; Paler, K. (Science Research Council, Chilton (UK). Rutherford Lab.). 1975. 39p. Dep. NTIS (US Sales Only) $5.00.

The reactions $K^-p \rightarrow K^-\pi^+\pi^-p$ and $K^-p \rightarrow \bar{K}^0\pi^-\pi^0p$ at 14.3 GeV/c were studied using respectively 15992 and 3723 events. Partial wave analysis of the region $1.0 < m(K\pi\pi) < 1.7$ GeV was made using a modified version of the method developed at the University of Illinois. The cross section was measured as a function of mass for each spin–parity state of the $K\pi\pi$ system. Results from the two reactions are in excellent agreement and indicate an overall isospin of ½. It is found that the Q enhancement is predominantly $J^P = 1^+$, but that the partial wave substates have very different branching ratios into $K\rho$ and $K^*\pi$, the $K^*\pi$ component of the 1^+ state being similar to the 1^+ state of the 3π system produced in the reaction $\pi p \rightarrow (3\pi)p$. (auth)

12675 CALCULATION OF THE MESON-BARYON D/F RATIO. Meiere, F. T. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Nucl. Phys., B; 89: No. 3, 413-417 (28 Apr 1975).

It is argued that certain types of structure for the meson current permit a dynamical calculation of the D/F ratio for meson-baryon couplings. The observable coupling constants exhibit a phenomenological SU(3) structure for their leading term with a parameter $D/(D + F) \simeq 0.57$. It is not apparent why this approximates the SU(6) value 0.6 (auth)

12676 AN APPLICATION OF DISPERSION RELATIONS TO KAON-NUCLEON SCATTERING. Lyberg, M. D. (Niels Bohr Institutet, Copenhagen (Denmark)). Nucl. Phys., B; 89: No. 3, 429-444(28 Apr 1975).

In this paper predictions have been made for the invariant KN and $\bar{K}N$ scattering amplitudes in the kinematical region $q_{lab} < 15$ GeV/c and $0 > t > -0.7$ (GeV/c)^2. A direct fit to medium and high-energy data has been performed using a parametrization where the imaginary part of the amplitudes for energies above the phase-shift region is identical with the imaginary part of a Regge-pole amplitude, and the real part of the amplitudes has been obtained from a dispersion relation. The s-channel helicity amplitudes are compared with their counterparts in pion-nucleon scattering and other reactions. Exact exchange degeneracy cannot be verified. Also the real part of the amplitudes are compared with the real part of phase-shift solutions. There is a qualitative agreement between these two real parts even though they differ in detail. (auth)

12677 AXIAL VECTOR MESON PRODUCTION. Irving, A. C.; Chaloupka, V. (European Organization for Nuclear Research, Geneva (Switzerland)). Nucl. Phys., B; 89: No. 2, 345-356(21 Apr 1975).

Recently available differential cross section and density matrix information on $\pi^-p \rightarrow B^-p$ at 4 GeV/c are successfully described in terms of t channel exchanges and s channel absorptive effects. The s channel helicity amplitude which is dominant at small $|t|$ (zero net helicity flip ω exchange) is found to have a zero at $-t = 0.2$ GeV^2. SU(3) and higher symmetries are used to predict cross sections for further axial vector meson production processes, in particular non-diffractive A_1 production. The importance of these processes with regard to Regge phenomenology and meson spectroscopy is emphasized. (auth)

12678 AMBIGUITIES IN HARD-PHOTON THEOREMS FOR RADIATIVE πN SCATTERING. Picciotto, C. (European Organization for Nuclear Research, Geneva (Switzerland)). Nucl. Phys., B; 89: No. 2, 357-364(21 Apr 1975).

Recently developed hard-photon theorems, used to parametrize off-shell effects in radiative pion-nucleon scattering, are shown to suffer from ambiguities in terms of order k in an expansion in photon energy. These ambiguities can be shown to arise primarily from the arbitrary choice of parameters used to describe the strong amplitude. As expected from Low's soft-photon theorem, terms up to order k^0 are not affected by the choice of parameters. (auth)

12679 FINITE ENERGY SUM RULE EVALUATIONS FOR HYPERCHARGE EXCHANGE REACTIONS. Vanryckeghem, L. G. F. (Oxford Univ. (UK). Dept. of Theoretical Physics). Nucl. Phys., B; 90: No. 1, 161-188(5 May 1975).

Finite energy sum rules for the reactions $\bar{K}N \rightarrow \pi\Lambda$ and $\bar{K}N \rightarrow \pi\Sigma$ are evaluated in the narrow width resonance approximation. The high-energy SU(3) relations between the Λ and Σ amplitudes are used to check the sum rules. From the sum rules the t-dependence of the imaginary part of the s-channel helicity amplitudes is inferred. It is found that the odd signature exchange (K^*) non-flip amplitudes are peripheral. The even signature exchange (K^{**}) non-flip amplitudes are non-peripheral and have two closely spaced zeros around $t = -0.4$. The flip amplitudes are not exchange degenerate. For the vector exchanges SU(3) correctly relates the various non-strangeness and strangeness exchange sum rules. This relation is only approximate for the tensor exchanges. (auth)

12680 UNITARITY BOUNDS FOR EXCLUSIVE AND INCLUSIVE REACTIONS. Divakaran, P. P. (Tata Inst. of Fundamental Research, Bombay (India)); Kugler, M. (Weizmann Inst. of Science, Rehovoth (Israel)); Soffer, J. (Centre National de la Recherche Scientifique, 13- Marseille (France). Centre de Physique Theorique). Phys. Lett., B; 56: No. 2, 173-176(14 Apr 1975).

Many reactions are strongly constrained by the knowledge of the corresponding elastic amplitude. In some cases the bounds obtained are saturated within 25%. The method is applied to π^- diffraction. (auth)

12681 TEST FOR SCALING IN MULTIPLICITY DISTRIBUTION IN HIGH ENERGY π^-p COLLISIONS. Oli, R. C.; Tuli, S. K. (Banaras Hindu Univ.). Indian J. Pure Appl. Phys.; 12: No. 12, 839-841(Dec 1974).

The π^-p data up to 205 GeV/c were examined to test the onset of scaling in the multiplicity distribution. The ratios $\langle n^q\rangle/\langle n\rangle^q$ were calculated from the experimental data, and their energy dependence was studied. The experimental situation is compared with the predictions based on the models of H. B. Nielsen and P. Olesen [Niels Bohr Institute Preprint, NBI-HE-72-12] and of S. Barshay [Physics Lett., B 42 (1972), 457]. The suggestion is supported that certain characteristic features of multiplicity moments are of geometric origin. (auth)

12682 ANALYSIS OF HIGH ENERGY BACKWARD πN SCATTERING INCLUDING POLARIZATION DATA. Storrow, J. K.; Winbow, G. A. (Daresbury Lab., Warrington, Eng.). J. Phys., G. (London); 1: No. 3, 263-272 (1 Apr 1975).

Current data on πN backward scattering at 6 GeV/c are analyzed, assuming $I_u = 1/2$ is dominated by an N_α Regge pole. Two solutions are found, one resembling that given previously (Storrow and Winbow. Nucl. Phys.; B53: 62 to 90 (1973)), the other differing in the sign of Re $H^{\flat}_{++}$. The first solution can have a "geometrical" structure of zeros in $I_u = 3/2$, the second (which is a better fit) has zeros near $u = 0$ in both Im $H^{\flat}_{++}$ and Im $H^{\flat}_{+-}$. The solutions can be distinguished by measuring the sign of backward charge exchange polarization. (auth)

12683 DUALITY, CURRENT, AND CONSTITUENT QUARKS IN MESON–BARYON REACTIONS. Ruegg, H.; Savoy, C. A. (Univ., Geneva). Nuovo Cim., A; 26A: No. 3, 243-258(1 Apr 1975).

An algebraic realization of duality for meson–baryon scattering is presented. The resonant part of the PB → P′B′ amplitudes (P, P′ = 0^- mesons, B, B′ = any baryons) is calculated

by assuming PCAC, SU_3, $SU_{6W} \times O_3$ classification group for hadrons and the transformation between current quarks and constituent quarks. An "effective SU_{6W} invariance" is obtained and exploited. The vanishing of the contribution from the s-channel resonances to the t-channel exotic amplitudes calls for a relation between 56 and 70 resonances on the one hand and between 20 and 70 resonances on the other. The outcoming solution has an interesting pictorial interpretation: baryons behave in high energy scattering as a two-quark core, which does not react, plus one (valence) quark, which interacts with the meson. As a consequence, the 20 baryons (antisymmetric core) should never be produced out of a proton (symmetric core). The D/F ratio for the Regge couplings to the $\frac{1}{2}^+$ (56, L = 0) baryons is predicted to be small and negative. The production of all 70 L = 1 baryons from the proton is determined in terms of a few parameters. Sum rules are obtained for the O_3 structure of the axial charge and pionic coupling. (auth)

Strong (Baryon No. ≥ 2)

12684 (EFI-50(74)) INTERACTION OF HIGH ENERGY PARTICLES WITH ATOMIC NUCLEI. Gevorkyan, S. R. (Erevanskij Fizicheskij Inst. (USSR)). 1974. 56p. (In Russian). INIS.

This review considers contemporary, theoretical methods of investigating the interaction of high energy particles (E > 1 GeV) with atomic nuclei. A detailed study is presented of the approach of an eikonal and its relation with optics. By means of an eikonal concept for the scattering amplitude and on the assumption of the additivity of the scattering phases on separate nucleons, formulas are obtained of the Glauber theory of multiple scattering for cross sections of coherent and incoherent processes on arbitrary nuclei. In addition a discussion is presented of the elements of the theory of generating stable and unstable particles on atomic nuclei at high energies. Rules are presented for constructing amplitudes of coherent generation processes. As an illustration these rules are applied to the problem of finding the total cross section for photoabsorption on average and heavy nuclei ($A \gg 1$). The review considers the theory of the interaction of high energy particles with nuclei on taking into account the inelastic screening. It is shown how taking into account the inelastic screening in processes of photogeneration on nuclei leads to a change in cross section as a function of atomic number with increasing energy. (SJR)

12685 (ORO-3992-215) PION INCLUSIVE MOMENTUM DISTRIBUTION AT 90^0 IN HYDRODYNAMICAL MODEL. Chiu, C. B.; Wang, K. H. (Texas Univ., Austin (USA). Center for Particle Theory). 1975. Contract AT(40-1)-3992. 18p. Dep. NTIS $4.00.

It is shown that pion inclusive momentum distributions in pp-collisions at 90^0 up to FNAL and ISR energies can be accounted for by a hydrodynamical model, which has frame independence symmetry and incorporates the evaporation phenomena. Within the solution during its space–time development, the matter system only possesses a local thermal equilibrium but not a global equilibrium. The proper time interval needed to achieve this equilibrium comes out to be comparable to (with c equals 1) the longitudinal dimension estimated previously based on considerations of quantum statistical fluctuation. (auth)

12686 ELASTIC PROTON–PROTON SCATTERING AT LARGE MOMENTUM TRANSFER IN PARTON FIELD THEORY. Hayashi, K. (Kinki Univ., Higashi–Osaka, Osaka (Japan). Faculty of Science and Technology); Yabuki, H. (Kyoto Univ. (Japan). Research Inst. for Mathematical Sciences). Nucl. Phys., B; 90: No. 1, 146-160(5 May 1975).

The constituent interchange model is investigated by means of the DGSIN (Deser–Gilbert–Sudarshan–Ida–Nakanishi) integral representation for the Bethe–Salpeter wave function. It is shown that this model gives a consistent picture (i.e. magnitude and dependence on energy and angle) of proton-proton elastic large-angle scattering when the constituent mass is around 30 MeV. (auth)

12687 THE NUCLEAR SIZE DEPENDENCE OF LARGE MOMENTUM TRANSFER SCATTERING AND QUARK INTERACTION DYNAMICS. Farrar, G. R. (California Inst. of Tech., Pasadena (USA)). Phys. Lett., B; 56: No. 2, 185-189(14 Apr 1975).

A simple dynamic picture of hadron interactions is used to discuss the A dependence of large $p_\perp$ scattering and dilepton production. Observations in large $p_\perp$ experiments are explained. Important corrections to dilepton production cross sections are found, leading to acceptable agreement between colored-quark theory and experiment. (auth)

12688 A TWO-COMPONENT MODEL FOR TWO-BODY NUCLEON DIFFRACTION DISSOCIATION AND COMPARISON WITH DATA FROM π^-p AT 3.9 GeV/c AND p–p AT FERMILAB AND ISR ENERGIES. Berlad, G.;Grunhaus, J.; Hafen, E. S.; Hodous, M. F.; Hulsizer, R. I.; Karshon, U.; Kistiakowsky, V.; Levy, A.; Pless, I. A.; Wolfson, J. (Massachusetts Inst. of Tech., Cambridge (USA). Lab. for Nuclear Science). Phys. Lett., B; 56: No. 3, 297-300(28 Apr 1975).

The isospin $|M_0^1|^2$ amplitude measured by means of π^+p interactions at 3.9 GeV/c is compared to the low-mass diffraction dissociation distributions in the process p + p → p + X at incident momentum from 175 to 400 GeV/c and p + p → (nπ^+) + p at 1500 GeV/c. The comparison is made within the framework of a two-component model which predicts that the properties of the $|M_0^1|^2$ amplitude at 3.9 GeV/c should describe the p–p process. This prediction is shown to be in excellent agreement with the high-energy data. (auth)

12689 BREMSSTRAHLUNG RADIATION OF PHOTONS IN SCATTERING OF NEUTRONS BY NUCLEI WITH AN ARBITRARY SPIN. Kerimov, B. K.; Safin, M. Ya.; Yunis, A. T. (Moscow State Univ.). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 12, 60-69 (1974). (In Russian).

In the Born approximation equations are obtained for the angular and energy distribution of bremsstrahlung photons emitted by relativistic neutrons in the field of a nucleus having electric quadrupole and magnetic dipole and octupole moments. The expression for the cross section ($d\sigma = d\sigma_E + d\sigma_m$) describes the summed, bremsstrahlung, electromagnetic radiation of neutrons which is a result of the interaction of the magnetic moment of the neutron with the electric (Ze, Q) and magnetic (μ_1, Ω) multipole moments of the target-nucleus. It is shown that in contrast to the bremsstrahlung radiation of electrons the cross section of bremsstrahlung radiation from neutrons does not contain an infrared divergence. A look is taken at the application of these formulas to the nuclei ^{9}Be and ^{27}Al. The results are applicable in investigating the electromagnetic radiation of neutral Fermi particles with a spin of $\frac{1}{2}$, and can be used to obtain additional information on the interaction of the magnetic moment with the multipole moments of a nucleus of arbitrary spin. (SJR)

12690 ATTRACTIVE POTENTIAL WITH FORBIDDEN STATES FOR THE N–N INTERACTION. Neudatchin, V. G.; Obukhovsky, I. T.; Kukulin, V. I.; Golovanova, N. F. (Moscow State Univ.). Czech. J. Phys.; 25: No. 3, 302-310(1975).

A potential model with forbidden states for describing the nucleon-nucleon interaction in the inner region is suggested. Forbidden states in the N–N system may occur due to the composite structure of nucleons as a consequence of the Pauli exclusion principle. A consistent description of singlet even phase shifts at energies up to 400 MeV was obtained. The generalization of Levinson's theorem taking forbidden states into account permits a new interesting interpretation of the phase shift data at higher energies and as a result gives a "smooth matching" of the low energy phase shifts with those of the asymptotic region $E \gtrsim 10$ MeV. The loop which the wave function has in the inner region provides a considerable contribution to the deuteron form factors at large momentum transfers. This leads to a better agreement of the electron-deuteron inelastic backward scattering cross sections with experiment. A comparison is made with the repulsive core model. Possible consequences for the three- and many-nucleon systems are discussed. (auth)

12691 HIGH MOMENTUM COMPONENTS OF THE DEUTERON WAVE FUNCTION. Alberi, G. (Univ., Trieste, Italy); Rosa, L. P.; Thome, Z. D. Czech. J. Phys.; 25: No. 3, 279-285(1975).

The tail of spectator distribution for the reaction $K^+d - K^+\pi^-pp$ is studied with the inclusion of inelastic intermediate states in the double scattering. The result seems to indicate the existence of high momentum components for the deuteron wave function. (auth)

12692 ANALYSIS OF RAPIDITY GAPS OF PRODUCED PARTICLES IN π^+d AT 5.1 AND 11.7 GeV/c. Barrier, M. (Univ., Paris); Brandao, A.; Loskiewicz, J. Nuovo Cim., A; 26A: No. 3, 259-280(1 Apr 1975).

An analysis of high-multiplicity π^+d reactions at 5.1 and 11.7 GeV/c is presented in terms of rapidity gaps between the final particles. The experimental data are compared with various models. The models generally underestimate the class of events corresponding to "single clusters". Characteristics of this class of events are studied. (auth)

12693 T = 1 AND T = 0 PAIRING INTERACTION. Navon, A. (Univ. of Quebec, Trois–Rivieres). Nuovo Cim., A; 26A: No. 3, 294-298(1 Apr 1975).

A model T = 1 and T = 0 pairing interaction is constructed. The eigenvalues and eigenfunctions of this interaction are calculated by using its invariance with respect of U_4. It is found

that the interaction strongly favors the formation of quadruples. (auth)

Particle Invariance Principles and Symmetries

General

Refer also to abstracts 12959 and 12966.

12694 (RL-75-009, pp I.48-I.69) INTRODUCTORY MATERIAL. Jones, G. T. (Univ. of Birmingham, Eng.). 1975.

In proceedings of the 1974 school for young high energy physicists.

The lecture covers what is symmetry; symmetry and conservation laws; broken symmetries and multiplets; the rotation group; the group SU(n); pictorial representation of multiplets; multiplets of elementary particles; strangeness or hypercharge; "large" multiplets of particles. (UK)

12695 WHY WE DO NOT SEE FERMION PARITY DOUBLETS. Bartels, J.; Savit, R. (National Accelerator Lab., Batavia, Ill. (USA)). Phys. Lett., B; 56: No. 1, 61-65(31 Mar 1975).

Renormalization groups arguments are applied to a Reggeon field theory which couples fermion and pomeron trajectories. The bare (input) fermion propagator has both positive and negative parity poles on the physical angular momentum plane for all values of u. However, after interacting with the Pomeron, the negative parity pole of the renormalized (output) fermion propagator migrates onto an unphysical angular momentum sheet for positive u, and so only the positive parity state appears as a physical particle. This provides a dynamical explanation for the disappearance of the negative parity partner, and is a property which is expected to be possessed by most reasonable Reggeon field theories. (auth)

12696 SPONTANEOUS BREAKDOWN OF INTERNAL SYMMETRY IN INTERNAL SYMMETRY X SUPERSYMMETRY. O'Raifeartaigh, L. (Dublin Inst. for Advanced Studies (Ireland)). Phys. Lett., B; 56: No. 1, 41-44(31 Mar 1975).

It is shown that the addition of supersymmetry to a (real irreducible, self-coupling) internal symmetry produces a Goldstone potential for the spontaneous breakdown of the internal symmetry along the (discrete) canonical directions, the supersymmetry remaining intact. (auth)

12697 WEAK, 4-FERMION INTERACTION IN TERMS OF INVARIANTS OF UNITARY SYMMETRY SU(3). I. Kurdgelaidze, D. F. (Moscow State Univ.). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 12, 113-122(1974). (In Russian).

The four-fermion, weak interaction in terms of invariants of the group G_2 = L⊗SU(2) and G_3 = L⊗SU(3). The four-fermion hamiltonion is constructed as a four-fermion invariant of Group G_3 constructed from spin-tensors $\phi^{l,m,n}_{\alpha,\beta,\gamma}$, where α, β, γ = 1, 2, 3, four-spinor, and l, m, n = 1, 2, 3 and unitary indices of the concept G_3. It is shown that in the case of a single multiplet $\phi^{l,m,n}_{\alpha,\beta,\gamma}$ it is possible to construct one nontrivial invariant, and in the case of two multiplets $\phi^{l,m,n}_{\alpha,\beta,\gamma}$ and $\phi^{l,m,n}_{\alpha,\beta,\gamma}$ there are ten nontrivial invariants. Of these invariants only in the case of two invariants containing two multiplets are the lepton and baryon numbers conserved independently. One of these invariants is considered in detail in these studies. In the SU(2) case there is no theoretical difficulty, and a series of ratios of constants of the weak interactions and probabilities is obtained. In the SU(3) case it is shown that the known violations of SU(3) in weak interactions can be localized in the lepton octet by selecting it in a special manner. (SJR)

12698 SPONTANEOUS BREAKDOWN OF THE GAUGE CHIRAL SYMMETRY AND THE CABIBBO ANGLE. Hosek, J. (Inst. of Nuclear Physics, Rez, Czech.). Czech. J. Phys.; 25: No. 5, 499-503(1975).

From the general treatment of the spontaneous breakdown of the chiral SU(3) × SU(3) group down to the electromagnetic U(1) gauge group it is conjectured that the bare Cabibbo angle is $\pi/4$. Imposing the self-consistency condition of Cabibbo and Maiani on the weak and electromagnetic corrections to the chiral symmetry breaking Hamiltonian $h = \epsilon_8 u_8 + \epsilon_3 u_3 + \epsilon_8 u_8$ leads to the determination of the physical Cabibbo angle. The agreement with the experimental value is reached when the parametrization of h of Brandt and Preparata is used. (auth)

Applications (Electromagnetic and Weak)

Refer also to abstracts 12951 and 12962.

12699 (CONF-750222-3) WEAK INTERACTION THEORIES AND PARITY MIXING IN ^{18}F AND ^{19}F. Gari, M.; Huffman, A. H.; McGrory, J. B.; Offerman, R. (Oak Ridge National Lab., Tenn. (USA)). 1974. 5p. Dep. NTIS $5.00.

From symposium on interaction studies in nuclei; Mainz, F. R. Germany (17 Feb 1975).

The nuclear structure calculations in fluorine-18 and -19 are used in testing parity admixing induced by the weak interaction leading to parity forbidden gamma decay, the asymmetry of which reaches an order of magnitude which can be seen by experiment if the level spacing of the admixed states is small and the induced transitions are not hindered. The uncertainties in the nuclear structure aspects in the calculation should be minimized. The asymmetry for the various energy-level transitions is calculated. (JFP)

12700 IS A LOW-MASS Z^0 IN GENERAL SU(2) ⊗ U(1) GAUGE THEORIES COMPATIBLE WITH EXPERIMENT. Glueck, M.; Reya, E.; Schilcher, K. (Mainz Univ. (F. R. Germany). Inst. fuer Physik). Phys. Lett., B; 56: No. 1, 73-75(31 Mar 1975).

It is shown that any simple SU(2) ⊗ U(1) gauge theory with a Z^0 mass much lower than the $W^\pm$ mass leads to serious conflicts with experiment. The case of deep inelastic neutral reactions is discussed in greater detail. (auth)

12701 A CHARGED PARTICLE IN A UNIFORM ELECTROMAGNETIC FIELD. A Group-Theoretical Analysis. Chen, L. C.; Janssen, T. (Katholieke Universiteit Nijmegen (Netherlands)). Physica; 77: No. 2, 290-310(15 Oct 1974).

A new covariant derivation is given for the relativistic symmetry group of a uniform electromagnetic field. The symmetry group of the equations of motion of a charged (classical, Klein-Gordon or Dirac) particle in such a field and its irreducible representations are determined. Using the representations the solutions of the equations of motion are discussed. Exact solutions can be given for the motion of a charged particle in an arbitrary uniform field. (auth)

Applications (Strong)

12702 WEIGHT DIAGRAMS FOR SUPERFIELDS. O'Raifeartaigh, L. (Dublin Inst. for Advanced Studies (Ireland)). Nucl. Phys., B; 89: No. 3, 418-428(28 Apr 1975).

A scheme for describing superfields by weight diagrams is proposed. The weights in such a diagram are just the conventional boson and fermion fields contained in a supermultiplet. As in the case of SU(3), the weight diagrams produce no new results, but they afford an easy visualization of the standard operations of supersymmetry, such as infinitesimal transformations, chiral reductions, and decomposition of products. (auth)

12703 CHIRAL SYMMETRY BREAKING AND THE K-N SIGMA TERM. Sastry, C. V.; Tiwari, T. N. (Regional Engineering Coll., Rourkela, India). Indian J. Pure Appl. Phys.; 12: No. 12, 846-847(Dec 1974).

The σ term for the kaon-nucleon scattering is calculated using the $(3, \bar{3}) \oplus (\bar{3}, 3) \oplus (8, 8)$ model of chiral symmetry breaking, proposed recently by A. Sirlin and M. Weinstein [Phys. Rev., D 6 (1972), 3588]. The present estimation gives $\sigma^{KK}_{NN} \cong (550 \pm 50)$ MeV, which is in much better agreement with the experimental value $\sigma^{KK}_{NN} = (540 \pm 160)$ MeV than the value estimated by the conventional $(3, \bar{3}) \oplus (\bar{3}, 3)$ model of Gell-Mann et al. [Phys. Rev., 175 (1968), 2195]. (auth)

12704 PSI-PARTICLES IN AN SU_4 SCHEME WITH ANOMALOUS CURRENTS. Das, T.; Divakaran, P. P.; Pandit, L. K.; Singh, V. (Tata Inst., of Fundamental Research, Bombay). Pramana.; 4: No. 3, 105-129(Mar 1975).

The recently discovered narrow peaks (the ψ-particles in e^+e^- system at 3.105 and 3.695 GeV are interpreted as hadrons in a broken SU_4 symmetry scheme. A new additional additive quantum number, paracharge Z, is combined with the usual SU_3 quantum numbers in the group SU_4. The $\psi(3.1)$ is assigned to a near ideally mixed $15 \oplus 1$ multiplet of vector mesons (containing the ρ) as the I = Y = 0, charge conjugation C = −combination of Z = ± 1 members. The ψ (3.7) is assigned correspondingly to another mixed $15 \oplus 1$ multiplet containing the $\rho'(1600)$. The hadronic electromagnetic interactions are modified by the addition of (nonminimal) anomalous pieces that can change Z. The decays of the ψ-particles are discussed. New enlarged SU_4 multiplets of other hadrons are proposed. Tests of the scheme are put forward. The most crucial test will be the observation of two rather broad resonances in e^+e^- collisions with masses around 4.2 and 5.1 GeV. Another prediction is the presence of energetic photons in the decays of the ψ-particles. Important results concerning the recently observed phenomena in the process $e^+e^- \to$ hadrons follow in this scheme. (auth)

Scattering Theory

Refer also to abstract 12977.

12705 (RL-75-009, pp II.1-II.32) SCATTERING THEORY. Cottingham, W. N. (Univ. of Bristol, Eng.). 1975.

In proceedings of the 1974 school for young high energy physicists.

The lecture deals with: SU groups, particle multiplets, Clebsch-Gordan coefficients, spherical harmonics, symmetry breaking, particle properties, application to meson-baryon scattering, the decay of unstable particles (the decay of K^* (890) $\rightarrow K\pi$), multipole expansion. (UK)

12706 RESONANCE POSITION AND REGGE TRAJECTORIES. Mandelbrojt, J. (Centre National de la Recherche Scientifique, 13- Marseille (France). Centre de Physique Theorique). Compt. Rend., Ser. A, B; 279: No. 21, 517-518(18 Nov 1974). (In French).

The bootstrap mechanism is shown to be simplified for Regge-like amplitudes beyond a certain value of the energy s, because each singularity of the sum of contributions from a Regge family coincides, in projection on the s plane, with a singularity or a limit of the singularity projections, of the overall amplitude. (auth)

12707 COMMENTS ON THE VALIDITY OF THE UNITARY POLE APPROXIMATION. Bakker, B. L. G. (Vrije Univ., Amsterdam); Sandhas, W. Czech. J. Phys.; 25: No. 3, 259-263(1975).

The remarkable validity of the unitary pole approximation of the two-body transition operators in the Faddeev kernel is explained. An efficient method for calculating correction terms is given. (auth)

12708 GENERALIZED MOMENT PROBLEM. Yatsun, V. A. (Inst. for Theoretical Physics, Kiev). Helv. Phys. Acta; 47: 631-644(1974).

The generalized moment problem, which arises from analysis of the Froissart-Gribov formula for partial amplitudes is considered. The necessary and sufficient conditions of solvability of the problem by reducing it to a power problem are obtained. (auth)

12709 VIRIAL THEOREM AND SCHWINGER'S VARIATIONAL PRINCIPLE IN COLLISION THEORY. McWhirter, J. D. G.; Moiseiwitsch, B. L. (Queen's Univ., Belfast). Proc. R. Irish Acad., Sect. A.; 74A: No. 12, 87-90(1974).

It is proved that if a scaling parameter is optimized using Schwinger's variational principle, a virial theorem is satisfied by the optimized variational functions and the variationally determined scattering amplitudes for inelastic as well as elastic collisions. Both the first and second Born approximations are shown to satisfy the virial theorem. Analogous results are also obtained in time-dependent scattering theory, and the equivalence between the time-dependent and independent treatments of the virial theorem for the scattering of high energy particles is established in the Born approximation. (auth)

12710 CHARGED PARTICLE SCATTERING IN THE PRESENCE OF A STRONG ELECTROMAGNETIC FIELD: EIKONAL APPROXIMATION. Zon, B. A. (Voronezh State Univ., USSR). J. Phys., B (London); 8: No. 6, L86-L87(21 Apr 1975).

A general formula for the cross section for potential scattering in the presence of a strong electromagnetic field is derived using the eikonal approximation for a force centre. (auth)

12711 INTEGRAL EQUATION FOR THE GEL'FAND-LEVITAN KERNEL IN TERMS OF THE SCATTERING POTENTIAL IN THE ONE-DIMENSIONAL CASE. Moses, H. E. (Air Force Cambridge Labs., Hanscom Air Force Base, MA). J. Math. Phys. (N.Y.); 16: No. 5, 1044-1046(May 1975).

An integral equation for the Gel'fand-Levitan kernel is given in terms of the scattering potential. This integral equation may be regarded as complementary to the Gel'fand-Levitan equation which is an integral equation for the kernel in terms of the Fourier transform of the reflection coefficient. (auth)

12712 VARIATIONAL PRINCIPLES, VARIATIONAL IDENTITIES, AND SUPERVARIATIONAL PRINCIPLES FOR WAVEFUNCTIONS. Gerjuoy, E. (Univ. of Pittsburgh, PA); Rau, A.R. P.; Rosenberg, L.; Spruch, L. J. Math. Phys. (N.Y.); 16: No. 5, 1104-1111(May 1975).

Variational principles and variational identities for bound state and continuum wave functions in a general context, paying particular attention to the proper choice of defining equations and boundary conditions which will lead to unique and unambiguous wave functions even when these functions are complex. Any functional, such as a matrix element, calculated with such a variationally determined wave function, will also be accurate to second order in the error of the starting choice. This provides, therefore, an alternative procedure for getting variational estimates of matrix elements to the one that already exists in the literature and the equivalence of the two is established. Of even more interest is the possibility which now seems open of going beyond the variational principle and generating "supervariational" estimates of wave functions and matrix elements which are good to better than second order. Also a simple prescription is given for the construction of variational identities for wave functions, that is, identities which lead readily to variational principles and, more significantly, might well serve as a starting point for the development of variational bounds. (auth)

12713 SOMMERFELD-WATSON REPRESENTATION FOR DOUBLE-SPECTRAL FUNCTIONS. P. 1. Potential Scattering Without Regge Poles. Atkinson, D.; Frederiksen, J. S. (Rijksuniversiteit Groningen (Netherlands). Instituut voor Theoretische Natuurkunde). Commun. Math. Phys.; 40: No. 1, 55-74(1975).

11 refs.

The existence of elastically unitary scattering amplitudes corresponding to a given Born term, is demonstrated when the latter satisfies certain conditions of Hoelder-continuity. The results are directly applicable to nonrelativistic potential scattering; and they will also be useful later in connection with the construction of relativistic, crossing-symmetric amplitudes. (GE)

12714 IMPLICATIONS OF UNITARITY FOR ELASTIC-SCATTERING AMPLITUDES. I. Bounds for the Absorptive Part. Schwarz, F. (Univ., Kaiserslautern, Ger.). Nuovo Cim., A; 26A: No. 2, 169-181(21 Mar 1975).

Upper and lower bounds are determined for the absorptive part of an elastic-scattering amplitude. The assumptions are only the unitarity condition and fixed values for certain constants like the forward amplitude and the integral over its absolute value. The bounds are explicitly evaluated for various cases. (auth)

12715 S-MATRIX REPRESENTATIONS FOR POTENTIALS WITH INFINITE RANGE. Dillig, M. (Univ. of Erlangen-Nuernberg, Erlangen, Ger.). Nuovo Cim., A; 26A: No. 3, 281-93(1 Apr 1975).

Unitary representations for the partial-wave S-matrix in terms of pole trajectories are derived in the complex angular-momentum plane for potentials with infinite range. Different properties of these representations are discussed; their validity is explicitly verified for the Coulomb potential. (auth)

PHYSICS (LOW-TEMPERATURE)

Superfluidity

12716 STATIC SUSCEPTIBILITY AND LONGITUDINAL RESONANCE FREQUENCY OF SUPERFLUID ^{3}He B. Ahonen, A. I.; Alvesalo, T. A.; Haikala, M. T.; Krusius, M.; Paalanen, M. A. (Helsinki Univ. of Technology, Otaniemi (Finland)). Phys. Lett., A; 51: No. 5, 279-280(24 Mar 1975).

The static susceptibility and the longitudinal resonance frequency of superfluid ^{3}He B have been measured at 18.7 bar from T_c to 0.27 T_c using continuous wave transverse NMR. (auth)

12717 SYMMETRY OF QUASI-PARTICLE COLLISION AMPLITUDES IN THE ANISOTROPIC PHASE OF SUPERFLUID ^{3}He. Seiden, J. (Paris- 11 Univ., 91- Orsay (France). Inst. d'Electronique Fondamentale). Compt. Rend., Ser. A, B; 279: No. 19, 487-490(4 Nov 1974). (In French).

The dissipation due to quasi-particle collisions, in the hydrodynamic range, is shown to have a cylindrical symmetry around the gap axis in the A phase of superfluid ^{3}He. (auth)

12718 MAGNETIC SUSCEPTIBILITY OF SATURATED MIXTURES OF HELIUM-3 IN SUPERFLUID HELIUM-4. Ghozlan, A.; Varoquaux, E. (Paris- 11 Univ., 91- Orsay (France). Inst. d'Electronique Fondamentale). Compt. Rend., Ser. A, B; 280: No. 7, 189-191(17 Feb 1975). (In French).

The magnetic susceptibility of dilute ^{3}He-^{4}He mixtures was measured along the phase separation curve at low pressures. The values for the interaction potential parameters obtained from these data check well with those deduced from other thermodynamic measurements. (FR)

12719 NEW METHOD FOR SOLVING THE MANY-BODY BOSON PROBLEM. I. Wong, K. W.; Fung, P. C. W. (Univ. of Kansas, Lawrence). Nuovo Cim.; 25B: No. 2, 595-632(11 Feb 1975).

A new method for solving the many-body boson system based on a generalized N-particle ground-state trial wave function and the principle of canonical transformation is developed. Explicit construction of the matrix representations and an iteration method are given. Some mathematical theorems and the range of validity pertaining to the theory are also presented. (auth)

12720 ON THE APPLICATION OF SPIN-FLUCTUATION THEORY TO SUPERFLUID ^{3}He. Fay, D. (Hamburg Univ. (F. R. Germany)). Phys. Lett., A; 51: No. 6, 365-366(7 Apr 1975).

Spin-fluctuation theory, modified to include non-paramagnon effects, is shown to be capable of yielding quantitative results for the pairing interaction and the Anderson-Brinkman parameter δ in a natural manner. (auth)

12721 MAGNETOSONIC WAVE IN THE A_1 PHASE OF SUPERFLUID ^{3}He. Maki, K. (University of Southern California, Los Angeles (USA). Dept. of Physics). Phys. Lett., A; 51: No. 6, 337-338(7 Apr 1975).

The dispersion of the spin wave as well as the magnetosonic wave in the A_1 phase is determined. The magnetosonic wave is the fourth sound accompanied by the magnetization, which provides almost unique means to determine the spin orientation of the condensate in the A_1 phase. (auth)

12722 THE ESCAPE OF POSITIVE IONS FROM QUANTIZED VORTEX LINES IN SUPERFLUID HELIUM. Ostermeier, R. M.; Glaberson, W. I. (Rutgers-the State Univ., New Brunswick, N. J. (USA). Dept. of Physics). Phys. Lett., A; 51: No. 6, 348-350(7 Apr 1975).

Trapping of positive ions by quantized vortex lines has been observed in superfluid helium. The thermally activated escape rate has been measured as a function of temperature and electric field and is compared with existing theories and a model calculation. (auth)

12723 EXCLUDED-VOLUME CONDITIONS AND RAMAN SCATTERING IN He II. Kleban, P.; Hastings, R. (Univ. of Minnesota, Minneapolis). Phys. Rev., B.; 11: No. 5, 1878-1883 (1 Mar 1975).

We consider the dynamic correlation function H(vector k, vector k',omega) appearing in the theory of Raman scattering in liquid helium. The simple fact that two atoms cannot overlap each other leads to an "excluded-volume condition" on the Fourier transform of H with respect to vector k' (or vector k) for all vector k (or vector k') and omega. It is demonstrated explicitly that none of the available calculations of H satisfy this condition. Hence, none of the existing direct quantitative interpretations of the Raman experiments is reliable. In particular, serious doubt is cast on the conclusiveness of the evidence for a two-roton bound state. Some related matters concerning the light-helium coupling function t are also discussed. It is argued that previous quantitative agreement between theory and experiment is due to compensating errors in H and t. An important "off-diagonal" property of H is also demonstrated. (auth)

Superconductivity

Refer also to abstracts 11927, 12029, 12107, 12113, 12134, 12140, and 12180.

12724 MICROTHEORETICAL ESTIMATION OF LASER INFLUENCE ON SUPERCONDUCTIVITY. Vujicic, G. M. (Boris Kidric Inst. of Nuclear Sciences, Belgrade); Tosic, B. S. Phys. Status Solidi B.; 69: No. 2, 655-659(1 Jun 1975).

The microtheoretical estimation of the superconductive gap behavior in the electromagnetic field is given. The approach to the problem is based on the mechanism of the retarded interaction between electrons. It is shown that the light quanta mainly decrease the magnitude of the superconductive gap. Also, the possibility to increase the gap is discussed, but the result is obtained under conditions near the limit of the validity of the method used. (auth)

12725 ANISOTROPY OF THE ASYMPTOTIC STRUCTURE OF ISOLATED FLUX-LINES AND PLANE PHASE BOUNDARIES IN CUBIC SUPERCONDUCTORS. Teichler, V. H. (Univ., Stuttgart). Philos. Mag.; 31: No. 4, 789-807(Apr 1975). (In German).

For arbitrary temperatures below T_c, the influence of the microscopic anisotropies of the coupled electron-phonon system on the asymptotic structure of a plane phase boundary in the intermediate superconducting state and of an isolated flux-line in the mixed state is studied. In particular the interrelationship between the microscopic anisotropies of the system and the anisotropy of the asymptotic coherence length and of the asymptotic penetration depth is discussed. (auth)

12726 THEORY OF H_{c2} ANISOTROPY IN CUBIC SUPERCONDUCTORS. Teichler, H. (Univ., Stuttgart). Phys. Status Solidi B.; 69: No. 2, 501-514(1 Jun 1975).

The anisotropy of the upper critical magnet field H_{c2} of cubic type-II superconductors with anisotropic Fermi surface and anisotropic attractive interaction is investigated. For a separable model interaction, explicit results are given on the temperature and impurity dependence of the H_{c2} anisotropy of impure metals in the "quasilocal" regime and of clean metals for arbitrary temperatures below T_c. The clean-limit results agree well with experimental data on H_{c2} anisotropy of high-purity Nb. (auth)

PHYSICS (NUCLEAR)

12727 (ZFK-283) JOINT ANNUAL REPORT, 1974. Netzband, D. (ed.). (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Aug 1974. 218p. (In German). Dep. NTIS (US Sales Only) $14.00.

148 brief reports are presented on the following topics: nuclear reactions, nuclear spectroscopy, nuclear theory, applied methods of nuclear physics, accelerators, nuclear electronics and methods, and computer codes. Lists of publications and lectures are also included. Individual reports with significant data are listed separately by title. (RWR)

For titles of individual papers see: 11558, 12049, 12050, 12199, 12528, 12534–12536, 12582, 12747, 12763–12765, 12777, 12790, 12796, 12801–12805, 12818–12826, 12833, 12834, and 12852.

Neutron Interactions with Matter

Refer also to abstracts 12567, 12884, 12887, 12904, 12935, 13586, 13587, and 13599.

12728 PLASMA INSTABILITIES AND RADIO AURORA. Oksman, J. (Oulu Univ. (Finland)). Ann. Geophys.; 30: No. 2, 285-290(Mar 1974).

From 2nd general scientific assembly of the International Association of Geomagnetism and Aeronomy; Kyoto, Japan (9 Sep 1973).

The existing theories of radio aurora are given. Experimental results are compared with the predictions of the different theories and conclusions are drawn as to the ability of the theories to explain the observations. (auth)

12729 POLAR-CAP ABSORPTION: OBSERVATIONS AND THEORY. Reid, G. C. (National Oceanic and Atmospheric Administration, Boulder, CO). Fundam. Cosmic Phys.; 1: No. 3, 167-200(Apr 1974).

A review is given of the effects of energetic solar particles (protons and heavy nuclei with energies in the MeV range) on the earth's ionosphere. The possible role of solar electrons is discussed in its context. (JFP)

12730 APPLICATION OF PYROLYTIC GRAPHITE AS A TUNABLE NEUTRON FILTER. Frikkee, E. (Stichting Reactor Centrum Nederland, Petten). Nucl. Instrum. Methods; 125: No. 2, 307-312(1 Apr 1975).

An investigation has been carried out on the neutron transmission through a pyrolytic graphite filter as a function of the filter orientation with respect to the beam. It is shown that highly aligned pyrolytic graphite may be tuned for optimum scattering of second-order neutrons in the wavelength range between 1.12 Å and 4.25 Å, by adjusting the filter in an appropriate orientation. Experimental results are presented for second-order neutrons with a wavelength 1.46 Å. (auth)

12731 FISSION SPECTRUM CALCULATIONS IN SLAB GEOMETRIES. Courtney, J. C.; Ambuehl, D. S. (Louisiana State Univ., Baton Rouge). Trans. Am. Nucl. Soc.; 21: 76-77(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12732 WALSH FUNCTION APPROXIMATION FOR NEUTRON TRANSPORT IN X-Y GEOMETRY. Seed, T. J. (Los Alamos Scientific Lab., NM); Albrecht, R. W. Trans. Am. Nucl. Soc.; 21: 227-228(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12733 LINEAR DISCONTINUOUS FINITE ELEMENT SCHEME IN TIME-DEPENDENT TRANSPORT CALCULATIONS. Hill, T. R. (Los Alamos Scientific Lab., NM). Trans. Am. Nucl. Soc.; 21: 228-230(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12734 INTEGRAL TRANSPORT FOR 2-D BENCHMARK, SHIELDING PROBLEMS. Loyalka, S. K.; Tsai, R. W. (Univ. of Missouri, Columbia). Trans. Am. Nucl. Soc.; 21: 230-231 (Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12735 HALF-RANGE ORTHOGONALITY IN TWO-GROUP TRANSPORT THEORY. Ishiguro, Y. (Instituto de Energia Atomica, Sao Paulo, Brazil). Trans. Am. Nucl. Soc.; 21: 233-234(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12736 EVALUATION OF ENDF/B-IV. Hardie, R. W.; Schenter, R. E.; Wilson, R. E. (Westinghouse Hanford Co., Richland, WA). Trans. Am. Nucl. Soc.; 21: 464-465(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12737 NUCLEAR DATA FOR CALCULATION OF RADIOACTIVITY EFFECTS. Schenter, R. E. (Westinghouse Hanford Co., Richland, WA); England, T. R. Trans. Am. Nucl. Soc.; 21: 517-518(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12738 ANISOTROPIC MULTIGROUP NEUTRON TRANSPORT WITHOUT LEGENDRE CROSS-SECTION EXPANSIONS. Odom, J. P.; Shultis, J. K. (Kansas State Univ., Manhattan). Trans. Am. Nucl. Soc.; 21: 530(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12739 TOTAL NEUTRON CROSS-SECTION CHECKS FOR IRON, CHROMIUM, NICKEL, CARBON, AND SODIUM. Maerker, R. E.; Muckenthaler, F. J. (Oak Ridge National Lab., TN). Trans. Am. Nucl. Soc.; 21: 530-532(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12740 COMPARISON OF EXPERIMENT AND CALCULATION OF THE ORNL OXYGEN INTEGRAL EXPERIMENT. Cramer, S. N.; Oblow, E. M. (Oak Ridge National Lab., TN). Trans. Am. Nucl. Soc.; 21: 532-533(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12741 COMPARISONS OF MEASURED NEUTRON FLUXES WITH ANISN AND SABINE CALCULATIONS. Robert, J. T.; Courtney, J. C. (Louisiana State Univ., Baton Rouge). Trans. Am. Nucl. Soc.; 21: 547-548(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12742 TRANSIENT IONIZATION EFFECTS FROM NEUTRON–SECONDARY GAMMA RADIATION IN THE UPPER ATMOSPHERE. Roberts, J. P.; Wicklund, J. S. (Harry Diamond Labs., Washington, DC). Trans. Am. Nucl. Soc.; 21: 549(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12743 OBSERVED PENETRATION OF 14-MeV NEUTRONS IN VARIOUS MATERIALS. Logan, C. M.; Komoto, T. T. (Univ. of California, Livermore). Trans. Am. Nucl. Soc.; 21: 552(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12744 EXTENSION OF THE CASE FORMULAS TO L/sub p/. Application to Half and Full Space Problems. Larsen, E. W. (New York Univ., NY); Sancaktar, S.; Zweifel, P. F. J. Math. Phys. (N. Y.); 16: No. 5, 1117-1121(May 1975).

The singular eigenfunction expansions originally applied by Case to solutions of the transport equation are extended from the space of Hoelder-continuous functions to the function spaces X/sub p/ equals [f parallel bar muf(mu)epsilonL/sub p/], where the expansions are now to be interpreted in the X/sub p/ norm. The spectral family for the transport operator is then obtained explicitly, and is used to solve transport problems with X/sub p/ sources and incident distributions. (auth)

12745 THE UTILITY FACTOR CRITERION APPLIED TO DOUBLE JACOBI POLYNOMIAL APPROXIMATIONS IN MONOENERGETIC TRANSPORT THEORY. III. De Corte, L. (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)). Atomkernenergie; 25: No. 1, 25-30(1975).

2 figs.; 1 tab.; 10 refs. Part of a thesis by L. De Corte.

A new criterion (called "utility factor" criterion) was introduced by Kofink to investigate the deviation of a generalized polynomial approximation from the exact solution. It is applied to the double Gegenbauer polynomial solution at the boundary plane of Milne's problem (for absorbing media and isotropic scattering). Both lowest order approximations are considered for polynomial systems which, according to another criterion of Kofink, fulfil the physical requirements. Double Legendre polynomials or Gegenbauer polynomials ($\alpha = \beta = \delta$) with a parameter $\delta \leq 0$ are preferred depending on the cases of weak or strong absorption respectively. (GE)

12746 INITIAL VALUE PROBLEM FOR THE NEUTRON TRANSPORT EQUATION BY THE SEMI-GROUP METHOD.

Barone, E. Atti Accad. Naz. Lincei, Rend., Cl. Sci. Fis., Mat. Nat.; 55: No. 5, 429-436(Nov 1973). (In Italian).

Two differential problems present in the theory of neutron transport in a Sobolev space dissymetric with weight were studied by the operator semi-group method. The existence and uniqueness of the solution was established. (tr-auth)

Nuclear Properties and Reactions, A ≤ 5

Refer also to abstract 12282.

12747 (ZFK-283, pp 16-17) KINEMATICALLY COMPLETE MEASUREMENTS OF DEUTERON BREAKUP WITH PROTONS OF 7, 8.5, AND 10 MeV. Kuehn, B.; Kumpf, H.; Moesner, J.; Neubert, W.; Schmidt, G. Aug 1974. (In German).

In joint annual report, 1974.

12748 COMPARISON OF A D(α,n(POL))αp MEASUREMENT WITH A MODIFIED IMPULSE APPROXIMATION PREDICTION. Knox, H. D.; Graves, R. G.; Rad, F. N.; Evans, M. L.; Northcliffe, L. C. (Texas Agricultural and Mechanical Univ., College Station (USA). Cyclotron Inst.); Nakamura, H. (Aoyama Gakuin Univ., Tokyo (Japan). Coll. of Science and Engineering); Noya, H. (Hosei Univ., Tokyo (Japan)). Phys. Lett., B; 56: No. 1, 33-35(31 Mar 1975).

A measurement of the polarization of neutrons from the D(α,$\vec{n}$)ap reaction at 18° for E_α = 39.4 MeV compares favorably with a prediction given by a modified impulse approximation (semi-phenomenological method) although the need for some further improvement in the theory is indicated. (auth)

12749 THE INCOHERENT NEUTRON SCATTERING LENGTH OF ^{3}He. Sears, V. F.; Khanna, F. C. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Phys. Lett., B; 56: No. 1, 1-3(31 Mar 1975).

The complex incoherent neutron scattering length of ^{3}He is estimated on the basis of effective range theory and also by means of a Breit-Wigner analysis. Both methods indicate that the incoherent scattering is a factor 4 weaker than the coherent scattering. (auth)

12750 N-BODY INTEGRAL EQUATIONS AND FOUR-NUCLEON CALCULATIONS. Sandhas, W. (Univ., Bonn). Czech. J. Phys.; 25: No. 3, 251-258(1975).

The N-body extension of the Faddeev three-body theory is formulated in a novel approach. Comparison with other formulations is performed, and first numerical results for the ^{4}He nucleus are briefly discussed. (auth)

12751 HOW TO DO BETTER THAN BRUECKNER-HARTREE-FOCK. Zabolitzky, J. G. (Univ., Bochum, Ger.). Czech, J. Phys.; 25: No. 3, 264-269(1975).

A triple self-consistent Faddeev-Brueckner-Hartree-Fock method is briefly introduced. Its superiority over other self-consistent approaches is sketched. The nuclei ^{16}O and ^{4}He are calculated in FBHF scheme with available realistic forces. It is suggested that two-body forces themselves cannot account for all structure effects satisfactorily. (auth)

12752 TIME CHARACTERISTICS OF POTENTIAL DISPERSION OF SLOW S-NEUTRONS OF ATOMIC NUCLEI. Rudak, E. A.; Khil'manovich, A. M. (Inst. of Physics, Minsk). Vestsi Akad. Navuk BSSR, Ser. Fiz.-Mat. Navuk; No. 2, 69-71(1975). (In Russian).

The average time of detection of slow S-neutrons in the region of a nucleus-target in a potential dispersion is described. (tr-auth)

12753 BOUND STATES OF ^{4}He WITH LOCAL INTERACTIONS. Tjon, J. A. (Rijksuniversiteit Utrecht (Netherlands). Instituut voor Theoretische Fysica). Phys. Lett., B; 56: No. 3, 217-220 (28 Apr 1975).

The Yakubovsky four-body equations for the 0^+ state are solved in the bound-state region for the case of local central forces of the Yukawa type by using the Hilbert-Schmidt expansion. As a result the ground-state energy of ^{4}He is found to be -29.6 MeV. (auth)

12754 ON THE MONOPOLE AND QUADRUPOLE ISOSCALAR GIANT RESONANCES IN ^{4}He, ^{16}O, ^{20}Ne AND ^{40}Ca. Abgrall, Y. (Bordeaux-1 Univ., 33-Gradignan (France). Lab. de Physique Theorique); Caurier, E. (Centre National de la Recherche Scientifique, 67-Strasbourg (France). Centre de Recherches Nucleaires). Phys. Lett., B; 56: No. 3, 229-231(28 Apr 1975).

A microscopic treatment of the coupled monopole and quadrupole T = 0 vibrations is done in the framework of the generator coordinate method (GCM). The properties of the vibrational states, in particular, the transition strengths and the inelastic electron scattering form factors, are discussed and compared with the available experimental data. (auth)

12755 THE ^{3}He SPIN ANALYSING POWER OF 27 MeV PROTONS. Ware, R. H.; Smythe, W. R.; Ingalls, P. D. (Colorado Univ., Boulder (USA). Nuclear Physics Lab.). Nucl. Phys., A; 242: No. 2, 309-316(28 Apr 1975).

The ^{3}He spin analyzing power of hydrogen (protons) has been measured at a c.m. energy of 20 MeV at 14 c.m. angles from 40° to 160°. The measurement of ^{3}He target polarization was calibrated by measuring the ^{3}He spin analyzing power of ^{4}He at an energy and angle where it was -1.00. The proton-^{3}He differential elastic scattering cross section is also reported at a c.m. energy of 20.0 MeV for 36 c.m. angles from 20° to 170°. (auth)

12756 POLARIZATION TRANSFER IN THE ^{2}H(d(pol, n(pol))^{3}He REACTION AT THETA = 0°. Lisowski, P. W.; Walter, R. L.; Busch, C. E.; Clegg, T. B. (Triangle Universities Nuclear Lab., Durham, NC (USA)). Nucl. Phys., A; 242: No. 2, 298-308(28 Apr 1975).

The vector polarization transfer coefficient K'_y and the tensor analyzing power A_{zz} have been measured for the ^{2}H(d,n)^{3}He reaction at θ = 0° over an incident deuteron energy range from 1 to 15 MeV in 0.5 MeV steps. The results agree with the previous ^{2}H(d,n)^{3}He measurements of Simmons et al. and are nearly identical to the ^{2}H(d,p)^{3}H measurements of Clegg et al. in the region of overlap. The present results provide an accurate and complete set of the observables necessary to use the ^{2}H(d,n)^{3}He reaction as a source of polarized neutrons. (auth)

12757 INVESTIGATION OF ANALYZING POWER MAXIMA IN d-α ELASTIC SCATTERING. Grueebler, W.; Schmelzbach, P. A.; Koenig, V.; Risler, R.; Jenny, B.; Boerma, D. (Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. fuer Kernphysik). Nucl. Phys., A; 242: No. 2, 285-297(28 Apr 1975).

An investigation of the conditions for which the vector analyzing power or a component of the tensor analyzing power reaches its theoretical maximum value has been carried out. For d-α elastic scattering, a search for A_{yy} = 1 and A_y = -1 was made with the aid of a phase shift analysis. Three such points for A_{yy} and one possible point for A_y were found in the energy range between 3 and 17 MeV. The precise energies and angles for the maxima of A_{yy} were found experimentally using an interpolation method. The practical interest in using the results to calibrate polarized deuteron beams is discussed. A time reversal invariance test in connection with the findings of this investigation is proposed. (auth)

12758 PHASE-SHIFT ANALYSIS OF d-α ELASTIC SCATTERING BETWEEN 3 AND 17 MeV. Grueebler, W.; Schmelzbach, P. A.; Koenig, V.; Risler, R.; Boerma, D. (Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. fuer Kernphysik). Nucl. Phys., A; 242: No. 2, 265-284(28 Apr 1975).

Phase shifts for d-α elastic scattering have been extracted from differential cross sections and the vector and tensor analyzing powers of ^{4}He(d,d)^{4}He scattering in the energy range from 3 to 17 MeV. The angular momenta were restricted to $L \leq 4$ and mixing parameters ϵ^1 and ϵ^2. Good fits could be obtained to nearly all the experimental data analyzed. The total reaction cross section and polarization-transfer coefficients were predicted and compared with the measured data; satisfactory agreement was found within the experimental errors. Evidence for a new resonance was found between 11 and 15 MeV. (auth)

12759 THE POLARIZATION OF NEUTRONS FROM THE ^{2}H(d,n)^{3}He REACTION FOR DEUTERON ENERGIES FROM 1 TO 5.5 MeV. Galloway, R. B.; Hall, A. S.; Maayouf, R. M. A.; Vass, D. G. (Edinburg Univ. (UK)). Nucl. Phys., A; 242: No. 1, 122-128(21 Apr 1975).

The dependence of the polarization of the neutrons from the ^{2}H(d,n)^{3}He reaction on angle of emission and deuteron energy, in the range 1.1-5.45 MeV, was determined from the asymmetry in the scattering of the neutrons by ^{4}He. The polarization values are discussed both in relation to previously reported discrepant values and to the Beiduk, Pruett and Konopinski description of the ^{2}H-^{2}H reaction. (auth)

12760 EFFECT OF THE Δ(1236) ON THE TRINUCLEON CHARGE FORM FACTOR. Green, A. M. (Univ., Helsinki); Kouki, T.; Kallio, A. J.; Toropainen, P. Czech. J. Phys.; 25: No. 3, 270-275(1975).

The Δ(1236) is introduced into the wave functions of ^{3}He and ^{3}H and the charge form factor calculated. The effect is to slightly aggravate the already large discrepancy between theory and experiment for $q^2 \gtrsim 14$ fm^{-2}. However, there are two side benefits - a simple way to understand the d-wave contribution to the CFF, and a simple NΔ correlation function having a very good overlap with a more exact correlation. (auth)

12761 NEUTRON ASYMMETRY IN MUON CAPTURE BY FEW-NUCLEON SYSTEMS. Dogotar, G. E.; Salganic, Yu. A.; Eramzhyan, R. A. (Joint Inst. for Nuclear Research, Dubna, USSR). Czech. J. Phys.; 25: No. 3, 276-278(1975).

Importance of the velocity dependent terms upon the form of the energy dependence of the neutron asymmetry in muon capture by deuterons is demonstrated. (auth)

Nuclear Properties and Reactions, $6 \leq A \leq 19$

Refer also to abstracts 12699, 12751, 12754, 12871, and 12902.

12762 (CONF-750447-4) CLUSTERS AND EXOTIC PROCESSES. Schiffer, J. P. (Argonne National Lab., Ill. (USA)). 1975. 16p. Dep. NTIS $4.00.

From second international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

An attempt is made to present some data which may be construed as indicating that perhaps clusters play a role in high energy and exotic pion or kaon interactions with complex (A much greater than 16) nuclei. Also an attempt is made to summarize some very recent experimental work on pion interactions with nuclei which may or may not in the end support a picture in which clusters play an important role. (JFP)

12763 (ZFK-283, pp 11-12) STUDIES ON THE REACTION MECHANISM IN THE INTERACTION OF HIGH-ENERGY PROTONS WITH LIGHT NUCLEI. Komarov, V. I.; Kosarev, G. E.; Kusmin, E. S.; Molokanov, A. G.; Reshetnikov, G. P.; Savchenko, O. V.; Tech, Z. (Joint Inst. for Nuclear Research, Dubna, USSR). Aug 1974. (In German).

In joint annual report, 1974.

12764 (ZFK-283, pp 21-23) p−γ ANGULAR-CORRELATION STUDY OF THE NUCLEAR REACTION $^{10}B(d,p\gamma)^{11}B$ AT $E_d = 1.75$ MeV. Mende, A. (Karl-Marx-Univ., Leipzig). Aug 1974. (In German).

In joint annual report, 1974.

12765 (ZFK-283, pp 71-73) REACTION $^{16}O(\mu^-,\nu n)^{15}N$ THE CONTINUUM SHELL MODEL. Wuensch, R.; Barz, H. W.; Rotter, I. Aug 1974. (In German).

In joint annual report, 1974.

12766 ON THE IMPORTANCE OF MULTI-STEP PROCESSES IN THE REACTION $^{18}O(p,t)^{16}O$. Horsfjord, V. (Oslo Univ. (Norway). Fysisk Institutt). Phys. Lett., B; 56: No. 1, 9-12 (31 Mar 1975).

A coupled channels analysis of the reaction $^{18}O(p,t)^{16}O$ has been performed, using the weak coupling wave functions of Ellis and Engeland. It is found that these wave functions are consistent with the data. The rather sizeable contributions from transitions via the ^{16}O ground state play an essential role in producing this result. The data seem not to support the use of a strongly deformed single particle basis for the multiparticle-multihole components of the wave functions. (auth)

12767 AN OPEN-SHELL FINITE FERMI SYSTEMS APPROACH TO THE STRUCTURE OF A = 12 NUCLEI. Immele, J. D. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy); Mukhopadhyay, N. C. (European Organization for Nuclear Research, Geneva (Switzerland)). Phys. Lett., B; 56: No. 1, 13-16 (31 Mar 1975).

An extension of Migdal's theory of finite Fermi systems is specialized to an open-shell calculation of the T = 1 states in ^{12}C. The overall fit of the low energy excitation spectrum is found to be satisfactory. The rates of the weak transitions $^{12}B_{gs} \xrightarrow{\beta^-} {}^{12}C_{gs}$ are accurately predicted, yielding a considerable improvement over the closed-shell RPA calculation. Overestimation of the isovector magnetic dipole sum rule strength is observed and discussed. (auth)

12768 RELATIVISTIC CORRECTIONS FOR NUCLEON-RESONANCE CONFIGURATIONS. Weber, H. J. (Virginia Univ., Charlottesville (USA)). Phys. Lett., B; 56: No. 1, 21-25(31 Mar 1975).

Relativistic three-body theory is used to calculate the ($\Delta\Delta$) configuration of the deuteron ground-state wave function in the one-pion-exchange approximation. Resulting relativistic effects are appreciable but do not change the non-relativistic wave functions qualitatively. (auth)

12769 STUDY OF THE ELECTROMAGNETIC DEEXCITATION OF THE SECOND LEVEL $J^\pi = 4^+$ OF ^{16}O AT 11.096 MeV. Brochard, F.; Chevallier, P.; Disdier, D.; Rauch, V.; Scheibling, F. (Centre National de la Recherche Scientifique, 67- Strasbourg (France). Centre de Recherches Nucleaires; Strasbourg- 1 Univ., 67 (France)). J. Phys. (Paris).; 36: No. 2, 113-115(Feb 1975). (In French).

The decay properties of the second $J^\pi = 4^+$ level in ^{16}O situated at $E_\gamma = 11.096$ MeV were investigated using the $^{12}C + \alpha$ reaction. The γ-γ coincidence measurements obtained with two NaI(Tl) detectors allow a deduction to be made of the intensities of two transitions: $GAMMA_{11.096 \to 6.918\ MeV} = 2.5 + -0.6$ MeV, $GAMMA_{11.096 \to 6.131\ MeV} = 3.1 + -1.3$ MeV. (auth)

12770 TOTAL CROSS SECTIONS FOR PIONS ON LIGHT NUCLEI. Batty, C. J. (Rutherford Lab., Chilton, Eng.). Czech. J. Phys.; 25: No. 3, 286-287(1975).

Some measurements of pion total cross sections are made for π^+ and π^- mesons on lithium-6 and -7, beryllium-9, and carbon-12 at 90 to 850 MeV and for oxygen-16 between 90 and 230 MeV. (JFP)

12771 DISCOVERY OF A $^3/_2^+$ STATE IN ^{15}N. Beukens, R. P.; Drake, T. E.; Litherland, A. E. (Toronto Univ., Ontario (Canada). Dept. of Physics). Phys. Lett., B; 56: No. 3, 253-254(28 Apr 1975).

A new resonance has been discovered in the $^{14}C(p,\gamma)^{15}N$ reaction at $E_p = 519$ keV ($E_x = 10.693$ MeV) with $\Gamma > 40$ MeV and $\omega\gamma = 2.4 \pm 0.5$ MeV. This state is assigned $J^\pi = {}^3/_2^+$ and is identified with a predicted $J = {}^3/_2^+$ 3p-4h state. The E3 ground-state decay of the $^1/_2^+$ (7.56 MeV) level was also observed, and the branching ratio was determined to be (1.3 ± 0.6)%. (auth)

12772 MEASUREMENT OF THE BREMSSTRAHLUNG SPECTRUM PRODUCED BY PROTON SCATTERING ON CARBON. Cristallini, A.; Maroni, C.; Massa, I.; Vannini, G. (Bologna Univ. (Italy). Istituto di Fisica). Phys. Lett., B; 56: No. 3, 245-246(28 Apr 1975).

The spectrum of low-energy γ-rays resulting from proton scattering on ^{12}C has been measured. The results are sensitive to the existence of resonant states in the ^{13}N system, in agreement with the prediction of the theory. (auth)

12773 PROTON POLARIZATION IN $^{16}O(p,p_0)^{16}O$ AND STATES IN $^{17}F^*$. II. Hiddleston, H. R.; Aymar, J. A.; Darden, S. E. (Notre Dame Univ., Ind. (USA). Dept. of Physics). Nucl. Phys., A; 242: No. 2, 323-344(28 Apr 1975).

The proton polarization in $^{16}O(p,p_0)^{16}O$ has been measured for laboratory proton energies between 10.0 and 16.0 MeV. Measurements were made for 18 or more angles at 60 energies. In addition, excitation functions of polarization were measured at 6 angles in 50 keV steps from 12.8 to 16.0 MeV. Both optical-model and phase-shift analyses were performed using published cross-section data in conjunction with the polarization data. The energy dependence of the complex phase shifts yielded spin, parity, and width assignments for 10 levels in ^{17}F and possible assignments for 10 additional levels. A review of the energy levels of ^{17}F below 16 MeV is given. (auth)

12774 EXCITED STATES OF ^{10}B FROM THE $^6Li(\alpha,\gamma)$ AND $^9Be(p,\gamma)$ REACTIONS. Auwaerter, W.; Meyer, V. (Zurich Univ. (Switzerland)). Nucl. Phys., A; 242: No. 1, 129-140(21 Apr 1975).

Excitation functions for the (α,γ) and (p,γ) reactions leading to ^{10}B have been measured at $\theta = 0°$ in the energy range from $E_x = 6.7$ to 7.6 MeV. Two resonances corresponding to levels at 6.88 and 7.44 MeV are observed. Branching ratios extracted from γ-ray spectra are the same in both reactions for the 6.88 MeV (1^-, T = 0 + 1) level, but different at 7.44 MeV. The T = 0 + 1 level at 7.44 MeV ($\Gamma = 90 \pm 10$ keV) is assigned 2^- or 2^+ from its strong branch to the 3^+ ground state. No evidence is found for a second isospin mixed 1^- state. (auth)

12775 ANOMALY IN α-SCATTERING FROM ^6Li BETWEEN 35 AND 45 MeV. Bernas, M. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire); Devries, R. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Nucleaire a Moyenne Energie); Harvey, B. G.; Hendrie, D.; Mahoney, J.; Sherman, J.; Steyaert, J.; Zisman, M. S. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Nucl. Phys., A; 242: No. 1, 149-159(21 Apr 1975).

The elastic scattering of α particles on ^6Li nuclei has been measured from 20° to 170° (c.m.) and the inelastic scattering to the first excited state of ^6Li has been measured for forward and backward angles. The elastic scattering angular distributions are calculated (i) in terms of pure potential scattering, (ii) in terms of potential scattering with an l-cut-off on the imaginary part of the potential, and (iii) in terms of the coherent addition of the potential scattering amplitude and of the exchange amplitude. The third method gives the best fit to the data. The inelastic angular distributions are compatible with the macroscopic

calculations, except in the very backward region where exchange phenomena are also shown to dominate. (auth)

12776 TRAPPING STATES IN STRIPPING REACTIONS. Ismail, M. Y.; Yousef, M. I. (Cairo Univ. (Egypt). Dept. of Physics). Atomkernenergie; 25: No. 1, 55-56(1975).

1 fig.; 6 refs.

The deuteron stripping reaction was investigated using a modified form of the trapping state model in the PWBA. The model assumes that the deuteron stripping in some reactions may occur as a two step process, at first the incident deuteron may be captured into a trapping state in the field of the target nucleus. Stripping may then take place from the trapping state at the closest approach between the deuteron and the target nucleus. The resulting angular distribution according to this model was compared with the results obtained according to the Butler and the DWBA differential cross sections for the reaction $^{12}C(d,p)\ ^{13}C^*$ (3.85) at the deuteron bombarding energy of 2.8 MeV (lab). It was found that this simple model can give a better representation for some types of nuclear reactions. (GE)

Nuclear Properties and Reactions, 20 ≤ A ≤ 38

Refer also to abstracts 12754 and 12762.

12777 (ZFK-283, pp 20-21) ANGULAR DISTRIBUTION OF α PARTICLES FROM THE REACTION $^{27}Al(p,\alpha)^{24}Mg$ AT E_p = 936 keV. Dolak, W.; Lehmann, D.; Lindner, K.; Otto, G.; Reich, G.; Treffkorn, H. J. (Karl-Marx-Univ., Leipzig). Aug 1974. (In German).

In joint annual report, 1974.

12778 A COMMENT ON BAND SPLITTING IN ^{24}Mg. Amiot, P. (Laval Univ., Quebec City (Canada)); Harvey, M.; Lee, H. C. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Phys. Lett., B; 56: No. 1, 26-28(31 Mar 1975).

The band splitting in ^{24}Mg arising from an unrestricted Hartree-Fock calculation is shown to be sensitive to an effective spin orbit interaction. Speculation is given on the origin of this spin-orbit effect. (auth)

12779 DE-EXCITATION OF ^{24}Mg FORMED BY $^{23}Na(p,\gamma)$ REACTION AT THE E(p) = 1,022 keV-RESONANCE. Barci, V. (Nice Univ., 06 (France)). Compt. Rend., Ser. A, B; 280: No. 5, 109-112(3 Feb 1975). (In French).

A study of the resonance at E_p = 1.022 keV of the reaction $^{23}Na(p,\gamma)^{24}Mg$: energy and lifetime of several ^{24}Mg excited levels (particularly the 4.238, 7.555, 7.748, 8.357, and 8.856 states) were measured, and a decay scheme is proposed. (auth)

12780 STUDY OF THE $(d_{5/2})^2_{J+}$ IN ^{22}Na AND ^{24}Na. Labie, E.; Leleux, P.; Macq, P. C. (Louvain Univ. (Belgium). Inst. de Physique Corpusculaire). J. Phys. (Paris), Lett.; 36: No. 1, L.1-L.3(Jan 1975). (In French).

The $^{20,22}Ne(\alpha,d)^{22,24}Na$ reactions were studied at 21.5 MeV. Strongly excited levels are located at (1.529 + − 0.006) MeV in ^{22}Na, and at (1.500 + − 0.008) MeV in ^{24}Na, which are attributed to the principal configuration $(d_{5/2})^2_{3+}$. DWBA adjustments were performed; both levels of interest are characterized by L = 4. (auth)

12781 THE EXPERIMENTAL SHAPE OF RESONANCE YIELD CURVES. Cunha, J. D.; Correa, P. M. (Laboratorio de Fisica e Engenharia Nucleares, Sacavem, Portugal). Nucl. Instrum. Methods; 125: No. 2, 265-268(1 Apr 1975).

Monte Carlo calculations were used to study the effects of the discrete character of the energy loss of bombarding particles in the shape of proton-resonance yield curves. It is shown for a large range of beam-energy dispersions and resonance widths that the resonance energy and width are systematically underestimated by the commonly used model of continuous energy loss. Graphs are presented which give the thin-target maximum-yield energy and the thick-target interquartile range and half-plateau energy; these graphs provide corrections to the results obtained with the usual continuous-energy-loss model in the analysis of experimental resonance yield curves. (auth)

12782 SYSTEMATIC EFFECTS OF CHARGE INDEPENDENCE BREAKING ON ENERGIES OF ANALOG STATES. Sherr, R. (Princeton Univ., N. J. (USA). Joseph Henry Labs.); Talmi, I. (Weizmann Inst. of Science, Rehovoth (Israel)). Phys. Lett., B; 56: No. 3, 212-216(28 Apr 1975).

Persistent and systematic evidence from energy differences of isobaric analog states demonstrates effects which are attributed to the difference in the neutron-neutron and proton-neutron interaction in T = 1 states. These effects are of the order of magnitude expected from analysis of nucleon-nucleon scattering data. (auth)

12783 PERTURBED ANGULAR DISTRIBUTIONS IN ^{41}Ca AND ^{42}Ca. Uhrmacher, M.; Gelberg, A.; Brandolini, F.; Kleinfeld, A. M.; Lieb, K. P. (Koeln Univ. (F. R. Germany). Inst. fuer Kernphysik). Phys. Lett., B; 56: No. 3, 247-249(28 Apr 1975).

Time integral implantation perturbed angular distribution experiments have been carried out for $^{41,42}Ca$ in Fe. The results point to interstitial implantation with an average hyperfine field of −34 ± 8 kG in addition to substitutional implantation. The g-factor of the 3.83 MeV, $(^{15}/_{2}^{+})$ state in ^{41}Ca has been measured in an external magnetic field and found to be g = +0.32 ± 0.04. (auth)

12784 TRANSFER REACTIONS INDUCED BY ^{16}O ON $^{29,30}Si$. Tserruya, I.; Bohne, W.; Braun-Munzinger, P.; Gelbke, C. K.; Grochulski, W.; Harney, H. L.; Kuzminski, J. (Max-Planck-Institut fuer Kernphysik, Heidelberg (F. R. Germany)). Nucl. Phys., A; 242: No. 2, 345-364(28 Apr 1975).

Angular distributions for one- and two-nucleon transfer reactions induced by ^{16}O on $^{29,30}Si$ and for the elastic scattering of ^{16}O on $^{28,29,30}Si$ have been measured at 73.5 MeV bombarding energy. The results are analyzed with the DWBA code BRUNHILD that includes recoil effects. Spectroscopic factors extracted for all observed transitions in one-nucleon transfer reactions agree well with those derived from light particle reactions. The effects of recoil on the spectroscopic factors for transitions to final states with different spins are discussed. The transitions from smooth to oscillating angular distributions are examined. It is found that the shape of the angular distributions depends on both the matching conditions of the reaction and the localization of the S-matrix amplitudes in L-space. (auth)

12785 PROJECTILE COULOMB EXCITATION OF ^{24}Mg. Biagi, S. F.; Phillips, W. R.; Barnett, A. R. (Manchester Univ. (UK)). Nucl. Phys., A; 242: No. 1, 160-174(21 Apr 1975).

The static quadrupole moment of the first excited $J^\pi = 2+$ state in ^{24}Mg and the reduced electric quadrupole transition probability between this state and the ground state were measured via projectile Coulomb excitation. The quadrupole moment was deduced from the shapes of γ-ray angular distributions. The result is $Q(^{24}Mg,2+) = -0.27 \pm 0.05$ b. The transition strength was deduced from yield measurements and by comparison with the yields of target γ-rays. The result is $B(E2;\ 0^+ \rightarrow 2^+,\ ^{24}Mg) = 0.044 \pm 0.003\ e^2b^2$. The experimental measurements are compared with theoretical predictions and previous measurements and a detailed discussion is given of corrections to this type of reorientation experiment. (auth)

12786 THE FT VALUE FOR THE SUPERALLOWED FERMI DECAY $^{38m}K(\beta^+)^{38}Ar$. Squier, G. T. A.; Burcham, W. E. (Birmingham Univ. (UK). Dept. of Physics); Freeman, J. M.; Petty, R. J. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment); Hoath, S. D.; Ryder, J. S. (Oxford Univ. (UK). Nuclear Physics Lab.). Nucl. Phys., A; 242: No. 1, 62-74 (21 Apr 1975).

The threshold energy for the reaction $^{35}Cl(\alpha,n)^{38m}K$ has been measured to be 6674.8 ± 3.2 keV, and the Q-value for the reaction $^{35}Cl(\alpha,p)^{38}Ar$ to be 837.2 ± 2.4 keV. From the measurements a value of 5021.2 ± 3.4 keV was obtained for the end-point energy of the beta plus decay of metastable ^{38}K to ^{38}Ar. The half-life was measured as 925.6 ± 0.7 ms, and hence an "effective" ft value was calculated, giving the results 3106 ± 10 s with the inclusion of outer radiative corrections to order $Z^2\alpha^3$, and 3088 ± 10 s allowing also for calculated charge-dependent effects. (auth)

12787 MEASUREMENT OF NEUTRON TOTAL CROSS SECTIONS OF SODIUM NEAR MINIMA. Brown, P. H.; Quan, B. L.; Weiss, J. J.; Block, R. C. (Rensselaer Polytechnic Inst., Troy, NY). Trans. Am. Nucl. Soc.; 21: 505(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12788 EFFECT OF REACTION TIME ON THE MINIMUM YIELDS OF AXIAL AND PLANAR BLOCKINGS. Fujimoto, F.; Komaki, K.; Nakayama, H.; Ishii, M.; Hasatake, K. (Univ. of Tokyo). pp 765-773 of Atomic Collisions in Solids. Vol. 2. Datz, S. (Ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

The effect of reaction time on the minimum yield of the axial and planar blockings is studied by use of the $^{27}Al(p,alpha)^{24}Mg$ resonance reactions at various energies. The result shows that the minimum yield of the axial blocking and mean square recoil distance have a linear relation. (6 figs, 11 refs) (auth)

12789 STUDY OF THE $^{32}S(\tau,d)^{33}Cl$ AND $^{32,33}S(\tau,\alpha)^{31,32}S$ REACTIONS. Inglima, G.; Caracciolo, R.; Cuzzocrea, P.; Perillo,

E.; Sandoli, M.; Spadaccini, G. Nuovo Cim.; 26A: No. 3, 211-225(1 Apr 1975).

The reactions $^{32}S(\tau,d)^{33}Cl$ and $^{32,33}S(\tau,\alpha)^{33,32}S$ were studied at 10.4 MeV incident energy. Absolute differential cross sections were measured and angular distributions were analyzed in terms of the distorted-wave Born approximation. Good agreement is obtained between experimental S-factors from the reactions on ^{32}S and the results of recent theoretical calculations, while S-factors from the $^{33}S(\tau,\alpha)^{32}S$ reaction are found to be considerably larger. The use of the (τ,α) reactions to obtain spectroscopic information and its DWBA analysis are examined and the accuracy of the extracted S-factors discussed. (auth)

Nuclear Properties and Reactions, 39 ≤ A ≤ 58

Refer also to abstracts 12754, 12762, and 12783.

12790 (ZFK-283, pp 76-77) MULTIPLE SCATTERING EFFECTS IN INELASTIC NUCLEON SCATTERING ON COMPLEX NUCLEI. Iwe, H. Aug 1974. (In German).

In joint annual report, 1974.

12791 INELASTIC HEAVY ION SCATTERING IN A FOLDING MODEL. Dover, C. B.; Moffa, P. J.; Vary, J. P. (Brookhaven National Lab., Upton, N. Y. (USA)). Phys. Lett., B; 56: No. 1, 4-8(31 Mar 1975).

Heavy ion inelastic scattering cross sections to low-lying collective states have been calculated in the framework of a folding model for the optical potential. The inelastic transition form factor is generated by deforming the target density directly, rather than the potential. Good agreement with experimental data for $^{58}Ni(^{16}O,^{16}O')\ ^{58}Ni^*(2^+)$ is obtained at 50, 60, and 70 MeV. A value of the deformation length $\beta_2 R_T$ is obtained which is consistent with that extracted from measured B(E2) values. (auth)

12792 THE EFFECT OF PICKUP-STRIPPING CONTRIBUTIONS ON THE SELECTION OF A UNIQUE ^{3}He OPTICAL POTENTIAL. Shepard, J. R.; Kunz, P. D.; Kraushaar, J. J. (Colorado Univ., Boulder (USA). Nuclear Physics Lab.). Phys. Lett., B; 56: No. 2, 135-138(14 Apr 1975).

The coupling of pickup-stripping channels in ^{3}He elastic scattering has been shown to have a large effect on the elastic cross section at back angles for higher projectile energies. Quantitative treatment of these effects leads to the conclusion that the "deep" family of mass-3 optical potentials is selected by fitting to high energy, back angle elastic scattering data. This is in contrast to recent optical model studies which have concluded that such data can be fit only by using a "shallow" potential. Consistency is now found between those mass-3 potential families required in certain reaction studies and those indicated for elastic scattering. (auth)

12793 CHEMICAL EFFECTS IN THE CAPTURE OF NEGATIVE MUONS. Mausner, L. F.; Naumann, R. A. (Princeton Univ., N. J. (USA). Joseph Henry Labs.); Monard, J. A.; Kaplan, S. N. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Phys. Lett., B; 56: No. 2, 145-147(14 Apr 1975).

Muonic Lyman-series X-ray spectra have been measured for several isoelectronic molecular series and related pure elements. Seven muonic Lyman series lines were observed from liquid argon with relative intensities consistent with neighbouring isoelectronic ions but in stark contrast to the single line previously reported for a gaseous argon target. The measured relative capture rates and Lyman intensity correlations provide new evidence for chemical structure influences on the capture of negative muons. (auth)

12794 Ti(τ,p) REACTIONS AT 15 MeV. II. $^{50}Ti(\tau,p)^{52}V$. Caldwell, T. (Pennsylvania Univ., Philadelphia (USA). Dept. of Physics); Pullen, D. J. (Lowell Technological Inst., Mass. (USA). Dept. of Physics); Hansen, O. (Niels Bohr Institutet, Copenhagen (Denmark)). Nucl. Phys., A; 242: No. 2, 221-231 (28 Apr 1975).

The $^{50}Ti(\tau,p)^{52}V$ reaction has been studied at 15 MeV incident energy using a multiangle spectrograph. Seventy-seven transitions up to 8.84 MeV in excitation have been identified, and many of the corresponding proton angular distributions measured. The distribution shapes together with DWBA calculations allow the assignment of a number of new spin and parity values. The results of the present work are compared with other data on ^{52}V. The isobaric spin (τ,p) intensity relations are applied to T = 3 and T = 4 states with $J^\pi = 0^+$ in ^{52}V, and it is found that the T = 3 levels take up only 18% of the expected anti-analog strength. (auth)

12795 PRECISION MEASUREMENT OF THE γ-RAY ENERGIES FROM THE RADIOACTIVE DECAY OF ^{51}Cr, ^{169}Yb, ^{170}Tm, ^{192}Ir AND ^{203}Hg. Borchert, G. L.; Scheck, W.; Wieder, K. P. (Kernforschungsanlage Juelich G. m. b. H. (F. R. Germany). Inst. fuer Kernphysik). Z. Naturforsch., A; 30: No. 3, 274-276 (Mar 1975).

6 tabs.; 11 refs.

The energies of the γ-rays from radioactive decay of ^{51}Cr, ^{169}Yb, ^{170}Tm, ^{192}Ir and ^{203}Hg were measured relative to the 411,794-keV standard from the decay of ^{198}Au with relative accuracies between 4×10^{-7} and 4×10^{-6}. (GE)

Nuclear Properties and Reactions, 59 ≤ A ≤ 89

Refer also to abstracts 12762, 12845, and 12871.

12796 (ZFK-283, pp 79-80) EXCHANGE EFFECTS IN INELASTIC PROTON SCATTERING ON ODD NUCLEI. Schmidt, R.; Reif, R. (Technische Univ., Dresden). Aug 1974. (In German).

In joint annual report, 1974.

12797 APPLICATION OF SUM RULES TO THE ELECTRO-EXCITATION OF ANHARMONIC VIBRATOR NUCLEI. Reinhard, P. G.; Drechsel, D. (Mainz Univ. (F.R. Germany). Inst. fuer Kernphysik). Phys. Lett., B; 56: No. 1, 17-20(31 Mar 1975).

Transition densities of low-lying states of anharmonic vibrator nuclei are calculated from generalized sum rule relations. In particular, such relations connect static multipole moments, transition probabilities and radii for these states. The results have been applied to the Zn isotopes, and good agreement has been obtained with recent electron scattering data. (auth)

12798 MAGNETIC MOMENT FROM TRANSFER REACTION STRENGTHS. Kumar, A.; Bansal, R. K. (Punjab Univ., Chandigarh (India). Dept. of Physics). Phys. Lett., B; 56: No. 2, 130-134(14 Apr 1975).

An explicit relationship between the magnetic moment of the target state and one-particle transfer reaction strengths has been derived. Test applications of the derived equation have also been presented. It has been emphasized how the calculation of the magnetic moment serves as a check on the accuracy of measured strengths. (auth)

12799 THE PRESENCE OF NONSTATISTICAL PREEQUILIBRIUM EFFECTS IN (n,2n) REACTIONS AROUND 14 MeV. Holub, E.; Cindro, N. (Institut Rudjer Boskovic, Zagreb (Yugoslavia)). Phys. Lett., B; 56: No. 2, 143-144(14 Apr 1975).

The contribution of nonstatistical preequilibrium effects in (n,2n) reactions at 14 MeV was deduced from the trend of the systematic deviation of experimental (n,2n) data from statistical predictions. Theoretical estimates of the effect compared with the contribution thus determined are found to be in fair agreement. (auth)

12800 THE DECAY OF ^{74}Kr. Schmeing, H.; Hardy, J. C.; Graham, R. L.; Geiger, J. S. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Nucl. Phys., A; 242: No. 2, 232-242(28 Apr 1975).

The decay of ^{74}Kr has been studied. Its half-life was determined to be $T_{\frac{1}{2}} = 11.50 \pm 0.11$ min. A decay scheme is proposed, based on γ-γ and β^+-γ coincidence measurements, which takes account of 99% of the strength of 57 observed γ-rays. The total decay energy was measured to be $Q_{ec} = 3327 \pm 125$ keV. The decay feeds the $(0,1)^-$, $T_{\frac{1}{2}} = 25.3$ min isomer of ^{74}Br. (auth)

Nuclear Properties and Reactions, 90 ≤ A ≤ 149

Refer also to abstracts 12845 and 12852.

12801 (ZFK-283, pp 24-25) HIGH-SPIN STATES IN ^{95}Tc. Winter, G. Aug 1974. (In German).

In joint annual report, 1974.

12802 (ZFK-283, pp 26-27) BAND STRUCTURES IN ^{123}I AND ^{125}I. Hagemann, U.; Keller, H. J.; Brinckmann, H. F. Aug 1974. (In German).

In joint annual report, 1974.

12803 (ZFK-283, pp 27-28) LIFETIME MEASUREMENTS OF $5/2^+ \rightarrow 1/2^+$ TRANSITIONS IN ODD Cs ISOTOPES. Arlt, R. (Technische Univ., Dresden); Beyer, G.; Ortlepp, H. G. Jachim, M.; Jasinski, A. Aug 1974. (In German).

In joint annual report, 1974.

12804 (ZFK-283, pp 28-29) NEW ISOTOPE $^{132}Pr(T_{1/2} =$ 1.6 MIN). Arlt, R. (Technische Univ., Dresden); Gromov, K.

Ya.; Latuszynski, A.; Ortlepp, H. G.; Jasinski, A. Aug 1974. (In German).
In joint annual report, 1974.

12805 (ZFK-283, p 29) STUDY OF ^{144}Nd IN THE (α,2n) REACTION. Rotter, H. (Zentralinstitut fuer Kernforschung, Rossendorf, Ger.); Brinckmann, H. F.; Heiser, C.; Berzins, J.; Beitins, M. Aug 1974. (In German).
In joint annual report, 1974.

12806 EXCITATION ENERGIES OF THE $h_{11/2}$ AND $d_{3/2}$ NEUTRON STATES IN ^{145}Gd AND ^{147}Dy. Toth, K. S.; Newman, E. (Oak Ridge National Lab., Tenn. (USA)); Rainis, A. E. (West Virginia Univ., Morgantown (USA)); Bingham, C. R. (Tennessee Univ., Knoxville (USA)); Carter, H. K.; Schmidt-Ott, W. D. (UNISOR, Oak Ridge, Tenn. (USA)). Phys. Lett., B; 56: No. 1, 29-32(31 Mar 1975).
A new activity is identified as ^{147m}Dy and the $d_{3/2}$ and $h_{11/2}$ neutron states are found to be at 27 and 749 keV in ^{145}Gd and 72 and 751 keV in ^{147}Dy. These energies confirm Silverberg's prediction that for N = 81 nuclei the $h_{11/2}$-$d_{3/2}$ splitting should reach a maximum at ^{139}Ce. (auth)

12807 QUASIPARTICLE-PHONON INTERACTION AND THE β-DECAY TO THE ONE PHONON COLLECTIVE STATES. Civitarese, O.; Krmpotic, F. (La Plata Univ. Nacional (Argentina). Departamento de Fisica). Phys. Lett., B; 56: No. 2, 123-126 (14 Apr 1975).
Using the quasiparticle-phonon interaction Hamiltonian, the β-decay processes to the first excited states of the doubly even spherical nuclei are calculated in first order perturbation theory. It is shown that the studies performed so far have not considered some leading order terms. The implications of the new terms are discussed in detail for the first forbidden β-decay from ^{124}Sb(3$^-$) to ^{124}Te(2$^+$). (auth)

12808 HIGH-SPIN STATES IN ^{127,129}La; A TEST OF BACK-BENDING IN THE EVEN Ba AND Ce NUCLEI. Ward, D.; Bertschat, H.; Butler, P. A.; Colombani, P.; Diamond, R. M.; Stephens, F. S. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Phys. Lett., B; 56: No. 2, 139-142(14 Apr 1975).
The $h_{11/2}$ band in ^{127,129}La has been identified to spin 35/2$^-$, and it does not backbend. This suggests that rotation-aligned $h_{11/2}$ protons are a major component of high-spin states in neighboring Ba and Ce nuclei which do exhibit backbending. (auth)

12809 THE OBSERVATION USING A SUM γ SPECTROMETER WITH COINCIDENCE TECHNIQUES, OF NEW TRANSITIONS OF LOW INTENSITY ACCOMPANYING THE ^{131}I DECAY. Bansart, C. (Nice Univ., 06 (France)). Compt. Rend., Ser. A, B; 279: No. 26, 673-675(23 Dec 1974). (In French).
The observation of new lines in ^{131}I, especially at 232.2 and 302.5 keV, allowed the characteristics of the 404.9 keV(3/2$^+$) and 667.0 keV(7/2$^-$) levels of ^{131}Xe to be determined. (FR)

12810 GAMMA-RAY ENERGIES OF SHORT-LIVED Rb, Sr, AND Y ISOTOPES INDICATING DELAYED NEUTRON EMISSION TO EXCITED STATES. Gunther, H.; Siegert, G.; Wuensch, K.; Wollnik, H. (Giessen Univ. (F. R. Germany). 2. Physikalisches Inst.). Nucl. Phys., A; 242: No. 1, 56-61(21 Apr 1975).
Gamma energies in the level schemes of ^{95,96,97}Sr, ^{95,96,97}Y, and ^{95,97}Zr are reported. Some of their excited levels are populated by delayed neutron emission. These nuclei were produced as daughters of Rb fission fragments originating from the reaction ^{235}U(n,f). By thermal ionization they were separated from fission products having other nuclear charge states and by an on-line mass separator according to their respective masses. (auth)

12811 A STUDY OF THE ^{106}Pd(p,d)^{105}Pd AND ^{106}Pd(^{3}He,d)^{107}Ag REACTIONS. Anderson, R. E.; Bunting, R. L.; Burch, J. D.; Chinn, S. R.; Kraushaar, J. J.; Peterson, R. J.; Prull, D. E.; Ridley, B. W.; Ristinen, R. A. (Colorado Univ., Boulder (USA). Nuclear Physics Lab.). Nucl. Phys., A; 242: No. 1, 75-92(21 Apr 1975).
The ^{106}Pd(p,d)^{105}Pd reaction has been studied at 22.9 MeV with an energy resolution of 13 keV. Angular distributions permitted the assignment of l-values and the extraction of spectroscopic factors for 13 states including several previously unresolved l = 2 transitions. The ^{106}Pd(^{3}He,d)^{107}Ag reaction has also been studied at 32.8 MeV with a resolution of 20 keV. Angular distributions were obtained, l-values assigned, and spectroscopic factors extracted for 14 levels including many not observed previously in a proton transfer reaction. The level structure of ^{105}Pd and ^{107}Ag is discussed particularly in terms of quasirotational bands. (auth)

12812 LEVEL STRUCTURE OF ^{106}Ag. Anderson, R. E.; Bunting, R. L.; Burch, J. D.; Chinn, S. R.; Kraushaar, J. J.; Peterson, R. J.; Prull, D. E.; Ridley, B. W.; Ristinen, R. A. (Colorado Univ., Boulder (USA). Nuclear Physics Lab.). Nucl. Phys., A; 242: No. 1, 93-121(21 Apr 1975).
The level structure of ^{106}Ag has been investigated through the use of the ^{103}Rh(α,nγ), ^{105}Pd(^{3}He,d), ^{107}Ag(p,d) and ^{104}Pd(^{3}He,p) reactions. The charged particle reactions provided the energies of 47 levels ranging up to 1684 keV and l-values were determined from the angular distributions for the neutron and proton transfer reactions to most of the states. Fifty-two γ-rays were assigned as transitions between the levels resulting from the charged particle data. Through the use of a combination of the l-values and γ-ray transitions the members of the $1g_{9/2}-2d_{5/2}$ and $2p_{1/2}-2d_{5/2}$ configuration multiplets have been deduced. The 6+ 8.4 d isomeric state has been located at 88 keV. The measurement of Q-values for the charged particle reactions has permitted determination of the mass of ^{106}Ag with greater precision than previously. (auth)

12813 QUASI-GAMMA BANDS IN EVEN-MASS Xe AND Ba NUCLEI. Kusakari, H.; Yoshikawa, N.; Kawakami, H.; Ishihara, M.; Shida, Y.; Sakai, M. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Nucl. Phys., A; 242: No. 1, 13-29(21 Apr 1975).
Low-lying excited states of ^{124,126}Xe and ^{132}Ba have been studied by means of in-beam γ-ray spectroscopy in (p,xnγ) reactions. Excitation functions, angular distributions and γ-γ coincidence spectra were obtained. The 2_γ+, 3$^+$, 4_γ+ and 5+ levels were observed at the following excitation energies in keV: 846.4(2_γ+), 1247.5(3+), 1437.3(4_γ+), 1836.6(5+) in ^{124}Xe, 879.7(2_γ+), 1317.3(3+), 1488.2(4_γ+), 1903.1(5+) in ^{126}Xe and 1032.1(2_γ+), 1511.3(3+), 1729.9 (4_γ+) in ^{132}Ba. The 2214.3 and 2561.7 keV levels in ^{126}Xe were tentatively assigned as the 6_γ^+ and 7$^+$ levels, respectively. These 2_γ^+, 3$^+$, 4_γ^+, 5$^+$, 6_γ^+ and 7$^+$ levels are interpreted as members of a quasi-γ band. The E2/M1 mixing ratios of the $2_\gamma^+ \rightarrow 2_1^+$ transitions in ^{124,126}Xe and ^{132}Ba were obtained as $+6.3^{+1.3}_{-1.0}$, $+10.8^{+1.8}_{-3.2}$ and $+8.3^{+4.1}_{-2.3}$, respectively. (auth)

12814 THE ^{114}In LEVEL SCHEME STUDIED BY THE (n,γ) REACTION. Rabenstein, D.; Harrach, D. (Technische Univ. Muenchen, Garching (F. R. Germany). Physik-Dept.). Nucl. Phys., A; 242: No. 2, 189-220(28 Apr 1975).
The level scheme of the nucleus ^{114}In has been studied using capture of thermal neutrons. The experimental information is taken from γ singles spectra and γ-γ coincidence spectra and from delayed coincidence measurements. Levels up to 1.4 MeV excitation energy are proposed. Several short lifetimes of excited states in ^{114}In and ^{116}In could be measured. The binding energy of the last neutron in ^{114}In, B_n = 7273.9 ± 1.2 keV, determined in this work is in strong disagreement with previously accepted values. Additional experimental information on the ^{116}In level scheme is given. Six states of the $(\pi(g_{9/2})^{-1}, \nu h_{11/2})$ multiplet (3$^-$ to 8$^-$) were identified in ^{114}In. The expected close similarity between many low-lying states in ^{114}In and ^{116}In could be confirmed. In particular, it was found that the anomalous high isomeric cross-section ratio of the second isomeric state results from very selective reorientation transitions within the negative-parity multiplet. The coupling constant of the quadrupole part of the residual neutron-proton interaction obtained from a theoretical calculation of the ^{114}In level scheme is similar in size to that of ^{116}In, thus giving credit to the explanation given in the previous ^{116}In work. The splitting of multiplets in doubly odd In nuclei gives additional information for an interpretation of the so-called $g_{7/2}$-$h_{11/2}$ anomaly in stripping studies near A = 110. Transition probability ratios B(M1)/B(E2) and E1 hindrance factors are discussed for both ^{114}In and ^{116}In. No sign of states exhibiting stable deformation similar to those in odd -A In nuclei has been found up to now in the doubly odd In nuclei studied. There is some evidence that these doubly odd In nuclei behave more like Cd than like single closed shell Sn nuclei. (auth)

12815 Q-VALUES FOR (d,p) AND (d,t) REACTIONS ON EVEN-A TIN ISOTOPES. Bechara, M. J. (Sao Paulo Univ. (Brazil)); Dietzsch, O. (Sao Paulo Univ. (Brazil); Pittsburgh Univ., Pa. (USA)). Z. Naturforsch., A.; 30: No. 3, 277-286 (Mar 1975).
1 fig.; 3 tabs.; 14 refs.
Relative Q-values for (d,p) and (d,t) reactions on all even-A tin isotopes were determined by simultaneous detection in nuclear emulsions placed in the focal plane of a magnetic spectrograph of the particle groups corresponding to the ground state transitions. The results when combined to other input data for the atomic mass tables provide more accurate mass excesses for nuclides in this mass region. (GE)

12816 NUCLEAR-STRUCTURE EFFECT IN THE K-CONVERSION PROCESS OF THE 223-keV TRANSITION IN ^{133}Cs. Ramaniah, K. V.; Reddy, K. V. (Andhra Univ., Waltair, India). Nuovo Cim.; 26A: No. 3, 237-242(1 Apr 1975).

The internal-conversion coefficient of the 223-keV transition in ^{133}Cs was determined using the relative intensities of the conversion lines measured with the intermediate-image beta-ray spectrometer and the relative gamma-ray intensities from the Ge(Li) data of Donnelley et al. and assuming the theoretical conversion coefficient of the intense 356-keV transition. The presently obtained K-conversion coefficient is employed along with the published data on the mixing ratio from the γ_{88}-γ_{223} correlation experiments to deduce the penetration parameter. The present results on the conversion coefficient and the penetration parameter are compared with earlier results. The anomalies in the conversion coefficients and the mixing ratios can be explained if the penetration effects are also considered, especially in the case of highly retarded M1 transitions. (auth)

12817 THICK-TARGET EXCITATION YIELDS OF PROMPT GAMMA-RADIATION FROM PROTON-BOMBARDMENT OF Rh, Pd, Ag, Pt, AND Au. Deconninck, G.; Demortier, G. (Facultes Universitaires Namur, Belgium). J. Radioanal. Chem.; 24: No. 2, 437-445(1975).

Thick-target excitation yields of prompt γ-rays following proton-bombardment are measured and tabulated for proton energies between 1 and 2.5 MeV. The application to quantitative elemental analysis of small amounts of noble metals is given. (auth)

Nuclear Properties and Reactions, 150 ≤ A ≤ 189

Refer also to abstracts 11563 and 12795.

12818 (ZFK-283, pp 30-31) DECAY ^{159}Tm(EC)^{159}Er. Strusny, H. (Zentral Institut fuer Kernforschung, Rossendorf, Ger.); Tyrroff, H.; Herrmann, E.; Musiol, G.; Basnat, M. I.; Beyer, G.; Gromov, K. Ya.; Islamov, T. A.; Kuznetsov, V. V.; Siebert, H. U. Aug 1974. (In German).
In joint annual report, 1974.

12819 (ZFK-283, pp 33-34) DECAY OF ^{161}Tm. Strusny, H. (Zentralinstitut fuer Kernforschung, Rossendorf, Ger.); Tyrroff, H.; Herrmann, E.; Adam, I.; Beyer, G.; Gromov, K. Ya.; Islamov, T. A.; Ortlepp, H. G. Aug 1974. (In German).
In joint annual report, 1974.

12820 (ZFK-283, pp 34-36) DECAY CHAIN ^{162}Yb(19.0 MIN) → ^{162}Tm(21.8 MIN) → ^{162}Er AND THE DECAY OF ^{160}Tm(9.2 MIN) TO ^{160}Er. Strusny, H. (Zentralinstitut fuer Kernforschung, Rossendorf, Ger.); Tyrroff, H.; Herrmann, E. Aug 1974. (In German).
In joint annual report, 1974.

12821 (ZFK-283, pp 37-39) DECAY OF ^{163}Tm. Strunsny, H. (Zentralinstitut fuer Kernforschung, Rossendorf, Ger.). Adam, I.; Gromov, K. Ya.; Islamov, T. A. Aug 1974. (In German).
In joint annual report, 1974.

12822 (ZFK-283, pp 39-40) DECAY OF ^{165}Tm. Strunsny, H. (Zentralinstitut fuer Kernforschung, Rossendorf, Ger.); Gromov, K. Ya.; Islamov, T. A. Aug 1974. (In German).
In joint annual report, 1974.

12823 (ZFK-283, pp 41-42) EXCITED STATES OF ^{178}Ta. Dubbers, F.; Funke, L.; Kemnitz, P.; Schilling, K. D.; Strusny, H.; Will, E.; Winter, G. Aug 1974. (In German).
In joint annual report, 1974.

12824 (ZFK-283, p 43) HIGH-SPIN ISOMERS IN ^{181}W. Kaeubler, L.; Andrejtscheff, W.; Manfrass, P.; Schilling, K. D. Aug 1974. (In German).
In joint annual report, 1974.

12825 (ZFK-283, pp 43-44) 1/2-[541] ROTATIONAL BAND IN ^{183}Re. Hedt, G.; Kemnitz, P. Aug 1974. (In German).
In joint annual report, 1974.

12826 (ZFK-283, pp 73-74) EFFECT OF THE CORIOLIS INTERACTION ON THE REACTION ^{156}Gd(d,t)^{155}Gd. Kuehne, J.; Wiebicke, H. J. Aug 1974. (In German).
In joint annual report, 1974.

12827 MICROSCOPIC CALCULATIONS OF ISOTOPIC SHIFTS AND GENERALIZED GIANT MULTIPOLE RESONANCES IN DEFORMED NUCLEI. Zawischa, D. (Technische Univ. Hannover (F. R. Germany). Inst. fuer Theoretische Physik); Speth, J. (State Univ. of New York, Stony Brook (USA). Dept. of Physics). Phys. Lett., B; 56: No. 3, 225-228(28 Apr 1975).

In the region of the deformed rare earth nuclei, extensive calculations of isotopic shifts and $K^\pi = 0^+$ excitations are performed. Good agreement with static and low-energy properties is obtained, and a resonance at 10-11 MeV is predicted. (auth)

12828 MULTIPOLE MIXING RATIOS OF γ-TRANSITIONS IN ^{182}W. Quinones, L. M.; Grabowski, Z. W. (Purdue Univ., Lafayette, Ind. (USA)). Nucl. Phys., A; 242: No. 2, 243-252 (28 Apr 1975).

γ-γ directional correlation experiments were performed on 14 cascades in ^{182}W populated from the β-decay of ^{182}Ta(115 d). Two Ge(Li) detectors were used in a coincidence arrangement, and the ^{182}Ta sources were dissolved in HF acid to minimize extranuclear perturbations. For the 1189 keV, $2^- \rightarrow 2^+$ transition, the measured directional correlation coefficients are consistent only with multipole mixing ratios $\delta(M2/E1) = 0.45 \pm 0.03$ and $\delta(E3/E1) = -0.67 \pm 0.07$. These mixing ratios are discussed and compared with the known conversion coefficients for the 1189 keV transition. The E2/M1 multipole mixing ratios determined are (energy in keV): $\delta(66) = 0.15 \pm 0.15$, $\delta(85) = 0.31 \pm 0.05$, $\delta(114) = 0.31 \pm 0.05$, $0.56 \leq \delta(179) \leq 1.36$, $\delta(1121) = 12^{+7}_{-\infty}$, and $\delta(1231) = -(32^{+14}_{-\infty})$. The measured M2/E1 mixing ratios are: $\delta(68) = 0.03 \pm 0.02$, $\delta(152) = 0.014 \pm 0.013$ and $\delta(156) = -0.13 \pm 0.19$. (auth)

12829 NEUTRON ACTIVATION CROSS SECTIONS AT 14.7 MeV FOR ISOTOPES OF TUNGSTEN. Qaim, S. M.; Graca, C. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Nuklearchemie). Nucl. Phys., A; 242: No. 2, 317-322 (28 Apr 1975).

Cross sections for (n,2n), (n,p), (n,α) and {(n,n'p) + (n,pn)} reactions at 14.7 ± 0.3 MeV on enriched ^{180,182,183,184,186}W isotopes have been measured by the activation technique using Ge(Li) detector γ-ray spectroscopy. Some systematic trends in the cross-section data have been analyzed. The (n,2n) reaction at this energy in this mass region is by far the most favored reaction and accounts for >80% of the total inelastic cross section. (auth)

12830 THE DECAY OF ^{159}Tm (9.0 min) TO ^{159}Er. Strusny, H.; Tyrroff, H. (Zentral Institut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)); Herrmann, E.; Musiol, G. (Technische Univ., Dresden (German Democratic Republic)); Baznat, M. I.; Beyer, G.; Gromov, K. Ya.; Honusek, M.; Islamov, T. A.; Kuznetsov, V. V. Nucl. Phys., A; 242: No. 1, 30-44(21 Apr 1975).

The decay of ^{159}Tm ($T_{1/2}$ = 9.0 ± 0.4 min) has been investigated with Ge(Li) and Si(Li) detectors, β-spectrographs and a toroidal β-spectrometer using isotopically separated samples produced by the YASNAPP facility at Dubna. The singles γ-ray spectrum, the conversion electron spectrum, the positron spectrum, prompt and delayed γ-γ coincidences were measured. Using strong thulium activities, conversion electrons were also measured with high resolution β-spectrographs. In the ^{159}Tm decay 81 new γ-ray transitions were observed. A decay scheme of ^{159}Tm is proposed involving 12 excited states in ^{159}Er. The first members of the rotational bands $3/2^-$[521], $5/2^-$[523], $3/2^+$([402 + 651]), $11/2^-$[505] and $1/2^-$[514] and the $5/2$, $1/2$ and $3/2$ states of a strongly perturbed positive parity band were identified. The Q-value of ^{159}Tm was determined to be 3.4 ± 0.3 MeV. (auth)

12831 STUDY OF THE ^{188}Os(p,t)^{186}Os, ^{190}Os(p,t)^{188}Os AND ^{192}Os(p,t)^{190}Os REACTIONS. Thompson, R. C.; Boyno, J. S.; Huizenga, J. R.; Elze, T. W. (Rochester Univ., N. Y. (USA). Nuclear Structure Research Lab.); Burke, D. G. (McMaster Univ., Hamilton, Ontario (Canada). Dept. of Physics). Nucl. Phys., A; 242: No. 1, 1-12(21 Apr 1975).

Cross sections and angular distributions have been measured for a number of levels populated in the ^{188}Os(p,t)^{186}Os, ^{190}Os(p,t)^{188}Os and ^{192}Os(p,t)^{190}Os reactions. Particular emphasis is placed on the identification of $J^\pi = 0^+$ levels. Excited levels with spin and parity of 0^+ were observed in ^{186}Os at 1061, 1456, 1953 and 1990 keV; in ^{188}Os at 1085, 1477, 1703 and 1823 keV; and in ^{190}Os in 911, 1543 and 1732 keV. The total percentages of the measured excited $l = 0$ transfer strength relative to the respective ground state strength for the three nuclei are ^{186}Os, 7%; ^{188}Os, 11%; and ^{190}Os, 11%. The relative strengths of the (p,t) ground state transitions for ^{190}Os, ^{188}Os, ^{186}Os are 1 : 0.80 : 0.70. Ground state Q-values for the (p,t) reaction on ^{188,189,190,192}Os targets are measured. (auth)

12832 GAMMA-RAYS IN THE ^{166}Tm DECAY. Adam, J.; Honusek, M.; Gromov, K. Ya.; Frana, J. (Inst. of Nuclear Physics, Rez, Czech.). Czech. J. Phys.; 25: No. 5, 504-513(1975).

Gamma-rays deexciting the ^{166}Er levels populated in the ^{166}Tm beta decay were investigated in the laboratory. The effort was concentrated on measuring low intensity gamma rays and on determining more accurately energies and intensities. Also

the present methods used in high-resolution gamma-ray spectroscopy in the studies are demonstrated. (auth)

Nuclear Properties and Reactions, 190 ≤ A ≤ 219

Refer also to abstracts 12795, 12817, 12831, 12838, 12845, and 12860.

12833 (ZFK-283, pp 46-48) HIGH-SPIN STATES IN THE PLATINUM ISOTOPES ^{190}Pt. Funke, L. (Zentralinstitut fuer Kernforschung, Rossendorf, Ger.); Kemnitz, P.; Winter, G.; Hjorth, S.; Johnson, A.; Lindblad, T. Aug 1974. (In German). In joint annual report, 1974.

12834 (ZFK-283, pp 48-49) EXCITATION SPECTRUM OF THE NUCLEUS ^{194}Pt. Winter, G.; Dubbers, F.; Funke, L.; Kemnitz, P.; Will, E. Aug 1974. (In German). In joint annual report, 1974.

12835 A DEVICE FOR IN-BEAM G-FACTOR MEASUREMENTS FOR ISOMERIC STATES IN THE RANGE OF A FEW HUNDRED NANOSECONDS. Roulet, C.; Albouy, G.; Auger, G.; Bourgarel, M. P.; David, J. C.; Lagrange, J. M.; Monsanglant, B.; Pautrat, M.; Richel, H.; Sergolle, H. (Paris- 11 Univ., 91-Orsay (France). Inst. de Physique Nucleaire). Nucl. Instrum. Methods; 125: No. 1, 29-40(15 Mar 1975).

G-factor and lifetime measurements were performed for isomeric states in the hundreds-nanoseconds range. A beam pulsar was built to increase the free time range between two beam bursts. The g factors were measured using a time-differential perturbed-angular-distribution method (TDPAD). A 20 kG static magnetic field was provided by a window-frame magnet with a small leakage field. Multidimensional techniques using the ARIEL computer facilities enabled us to perform a complete analysis of the data corresponding to all delayed γ lines in the same time. This new experimental setup allowed us to derive the g factors of some isomeric states (12^+ levels in neutron-deficient ^{194,196,198}Pb) and obtain accurate corresponding lifetimes. (auth)

12836 STUDY OF THE HIGH ENERGY γ RADIATION OF A ^{226}Ra SOURCE IN EQUILIBRIUM WITH ITS DERIVATIVES USING A PAIR SPECTROMETER. Hachem, A. (Nice Univ., 06 (France)). Compt. Rend., Ser. A, B; 279: No. 26, 677-680 (23 Dec 1974). (In French).

The spectrum from a ^{226}Ra source was obtained above 1.1 MeV as a line spectrum with a very high resolution. Several new gammas were observed. (auth)

12837 DEEXCITATION OF THE ^{214}Po LEVELS. Hachem, A.; Dalmasso, J.; Maria, H.; Ythier, C. (Nice Univ., 06 (France)). Compt. Rend., Ser. A, B; 279: No. 25, 609-612(16 Dec 1974). (In French).

The interpretation of the results obtained from γ-γ coincidence measurements effected with a ^{226}Ra source suggests the existence of new levels in ^{214}Po at 1275.0; 1743.2; 2423.4; 2508.5; 2662.7 and 2728.6 keV. The 1275.0 keV level probably emits a group of long range α radiations. (FR)

12838 STUDY OF THE γ RADIATION EMITTED IN THE DECAY OF ^{214}Bi USING A COINCIDENCE METHOD. Hachem, A.; Maria, H.; Dalmasso, J.; Ythier, C. (Nice Univ., 06 (France). Lab. de Chimie Physique Atomique et Structurale). Compt. Rend., Ser. A, B; 279: No. 23, 555-558(2 Dec 1974). (In French).

γ-γ coincidence measurements were carried out with a ^{226}Ra source in equilibrium with its products, and two semiconductor detectors. Seventy gamma transitions corresponding to the de-excitation of ^{214}Po were interpreted. (FR)

12839 QUASI-FISSION REACTIONS INDUCED BY 365 MeV ^{63}Cu IONS ON A ^{197}Au TARGET. Peter, J.; Ngo, C.; Tamain, B. (Paris- 11 Univ., 91- Orsay (France). Inst. de Physique Nucleaire). J. Phys. (Paris), Lett.; 36: No. 2, L.23-L.27(Feb 1975).

Quasi-fission and complete fusion cross sections were measured for the system ^{63}Cu + ^{197}Au at a bombarding energy equal to 1.1 times the interaction barrier. Like the krypton case, very few complete fusion events are observed, and the quasi-fission cross section (250 + −50 mb) is one half of the reaction cross section. A more precise determination of the mass of one of the products was performed. The mass distribution of the quasi-fission products varies with the angle of detection. The light products (mass around that of copper) show a clear maximum at an angle slightly lower than the grazing angle. The results suggest that events found at the low angles correspond to projectiles with low l-values which have undergone a greater mass exchange than the high l-value projectile. The total kinetic energy is constant as a function of the angle, or slightly increasing at forward angles. (auth)

Nuclear Properties and Reactions, A ≥ 220

Refer also to abstracts 12737 and 12882.

12840 SEARCH FOR SUPERHEAVY ELEMENTS IN NATURE. Stephan, C.; Tys, J. (Paris- 11 Univ., 91- Orsay (France). Div. de Physique Nucleaire); Sowinski, M. (Institute for Nuclear Research, Swierk (Poland)); Cieslak, E. (Warsaw Univ. (Poland)); Meunier, M. (Centre National de la Recherche Scientifique, 91-Orsay (France). Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse). J. Phys. (Paris).; 36: No. 2, 105-112(Feb 1975).

Superheavy elements were searched for by neutron-induced fission of mass-separated samples. Various natural materials were investigated: minerals, manganese nodules, lunar dust, meteoritic materials. Fissioning masses were collected in the A = 300 mass region. However, one cannot conclude that these masses are superheavy elements because of a possible contamination of this mass region by molecules containing natural uranium or thorium. To test for this possibility, the ratios of fast to thermal neutron events were determined in each separated mass region. These ratios cannot be completely understood as due to the fission of U or Th atoms. Some complementary results concerning the properties of the atoms contained in these masses are also given. (auth)

12841 HIGHER-ORDER SPACING CORRELATIONS IN ^{239}Pu AND ^{240}Pu. Jain, A. P.; Blons, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire). Nucl. Phys., A; 242: No. 1, 45-55(21 Apr 1975).

The set of 1^+ states in ^{239}Pu and $\frac{1}{2}^+$ states in ^{240}Pu, observed earlier by neutron capture studies, have been analyzed for long-range crystalline-like order in the spacing distributions. The smaller, but finite, long-range order is found in the data, as compared to that given by the Gaussian orthogonal ensemble of Dyson and Mehta. In order that these results can be considered as meaningful, it is necessary to use a complete set of levels with definite spin and parity. On the basis of several tests, it is rigorously proved that the set of states used form a complete set. The nature of the matrix elements of the Hamiltonian which can explain the experimental results is suggested. (auth)

12842 ISOTOPE DISTRIBUTION OF TRANSFER PRODUCTS IN THE ^{40}Ar + ^{232}Th INTERACTION AT 295 MeV. Jacmart, J. C.; Colombani, P.; Doubre, H.; Frascaria, N.; Poffe, N.; Riou, M.; Roynette, J. C.; Stephan, C. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire); Weidinger, A. (Muenchen Univ. (F. R. Germany)). Nucl. Phys., A; 242: No. 1, 175-188(21 Apr 1975).

The light product nuclei from the reaction ^{40}Ar + ^{232}Th at 295 MeV and at laboratory angles of 18° and 40°, were identified using combined ΔE-E and magnetic analysis techniques. The yield distributions and the kinetic energies of the reaction products have very distinct properties at these two angles. The data are consistent with the assumption of a predominant "quasi-elastic" reaction mechanism at 40° and a "deep inelastic" one at 18°. The isotopic dependence of the cross sections is not correlated with the ground state Q-values of the reaction. The experimental kinetic energies at 18° favor the interpretation that the observed nuclei are close to primary reaction products. (auth)

12843 FISSION CROSS SECTION OF ^{235}U AT 265 keV. Robertson, J. D.; Davis, M. C.; Engdahl, J. C.; Knoll, G. F. (Univ. of Michigan, Ann Arbor). Trans. Am. Nucl. Soc.; 21: 503(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12844 PRECISE MEASUREMENTS AND CALCULATIONS OF ^{238}U NEUTRON TRANSMISSIONS. Olsen, K. D.; de Saussure, G.; Silver, E. G.; Perez, R. B. (Oak Ridge National Lab., TN). Trans. Am. Nucl. Soc.; 21: 505-506(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12845 ABSORPTION CROSS-SECTION MEASUREMENTS FOR ^{252}Cf SPONTANEOUS FISSION NEUTRONS. Green, L. (Westinghouse Electric Corp., West Mifflin, PA). Trans. Am. Nucl. Soc.; 21: 506-507(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12846 SIMULTANEOUS FITS TO CAPTURE, FISSION, AND ETA DATA FOR ^{235}U IN THE THERMAL REGION. Leonard,

B. R. Jr.; Kottwitz, D. A. (Battelle Pacific Northwest, Labs., Richland, WA). Trans. Am. Nucl. Soc.; 21: 507-508(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12847 CALCULATED NEUTRON REACTION CROSS SECTIONS FOR ^{239}U. Gardner, D. G. (Univ. of California, Livermore). Trans. Am. Nucl. Soc.; 21: 508(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12848 FISSION-PRODUCT γ AND (γ,n) SPECTRA AND γ DECAY HEAT. Stamatelatos, M. G.; England, T. R. (Los Alamos Scientific Lab., NM). Trans. Am. Nucl. Soc.; 21: 508-509(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12849 DECAY OF ^{234}Pa. Ardisson, G.; Ardisson, C. (Faculte des Sciences, Algiers). Radiochem. Radioanal. Lett.; 21: No. 6, 357-364(16 Jun 1975). (In French).

Sources of ^{234}Pa(T = 6.7 h) were studied by γ spectrometry with a coaxial Ge(Li) detector. Energies and intensities of 159 γ rays were determined, of which 34 were found for the first time. A ^{234}U level scheme was constructed which interprets almost all γ rays. New levels were proposed at 1811.5, 1881.4 and 2144.1 keV. (2 figs.; 1 table) (auth)

Nuclear Theory

Refer also to abstract 12301.

12850 (KFK-2060) OPTICAL MODEL ANALYSIS OF NEUTRON CROSS SECTIONS AND STRENGTH FUNCTIONS. Newstead, C. M.; Cierjacks, S. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Angewandte Kernphysik). Mar 1974. 17p. INIS.

From EANDC topical conference on critique of nuclear models and their validity in the evaluation of nuclear data; Tokyo, Japan (27 Mar 1974).

Current problems met in the attempt to interpret fast neutron total cross sections with spherical and coupled channels optical model calculations are discussed. The energy dependence of the real and imaginary potential strengths is considered and progress in fitting neutron total cross sections over a wide energy range is discussed. Fluctuations in the strength of the imaginary potential are investigated in terms of the s- and p-wave neutron strength function. The role of strength function systematics in aiding study of the optical potential is developed. The implications of energy and mass dependences of the optical potential for neutron data predictions are outlined. (auth)

12851 (ORO-3992-211) VALIDITY OF SECOND ORDER ANALYSIS OF SUPERDENSE MATTER. Bowers, R. L.; Gleeson, A. M.; Pedigo, R. D. (Texas Univ., Austin (USA). Center for Particle Theory). 1975. Contract AT(40-1)-3992. 11p. (CPT-255). Dep. NTIS $4.00.

The limitations of relativistic calculations of the properties of superdense matter obtained from strictly second order terms is discussed. Extension of the model to overcome these limitations leads to serious complications which can only be overcome by a fully self-consistent treatment. (auth)

12852 (ZFK-283, pp 77-78) EXCHANGE EFFECTS IN INELASTIC SCATTERING BY A PSEUDOPOTENTIAL. Schmidt, R.; Reif, R. (Technische Univ., Dresden). Aug 1974. (In German).

In joint annual report, 1974.

12853 SIMULTANEOUS TREATMENT OF SURFACE AND PAIRING NUCLEAR FIELDS. Bes, D. R.; Dussel, G. G. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)); Broglia, R. A.; Liotta, R. (Niels Bohr Institutet, Copenhagen (Denmark)). Phys. Lett., B; 56: No. 2, 109-111(14 Apr 1975).

A nuclear field theory is presented in which surface and pairing degrees of freedom are treated on equal footing. The overcompleteness of the basis as well as Pauli principle violations are properly taken care of within the formalism. The results agree with the shell model treatment of the two body residual interaction. (auth)

12854 A NEW CLASS OF SCHROEDINGER OPERATORS FOR QUANTIZED FRICTION. Albrecht, K. (Muenchen Univ. (F. R. Germany). Sektion Physik). Phys. Lett., B; 56: No. 2, 127-129(14 Apr 1975).

After a brief outline of the quantal friction problem and recent approaches to it, a new class of non-linear Schroedinger equations is proposed. It contains as special cases the friction operators suggested by Sussmann and by Hasse. One of the operators has similar properties to Kostin's velocity potential, but is simpler in structure. (auth)

12855 SHELL CORRECTIONS TO NUCLEAR BINDING ENERGIES AND THE COHERENT STATE. Bhaumik, D. (Bose Research Inst., Calcutta (India)); Dasgupta, B.; Dutta-Roy, B. (Saha Inst. of Nuclear Physics, Calcutta (India)). Phys. Lett., B; 56: No. 2, 119-122(14 Apr 1975).

The small discrepancies between the observed nuclear binding energies and the standard semi-empirical mass formulae are usually attributed to quantum mechanical effects, namely the shell structure. This is because the semi-classical or statistical approach describes the nuclear energy spectrum as smooth functions. Since the microscopic approach to nuclear binding energies is a highly complicated one, the usual procedure is to correct the semi-classical values for the quantum shell effects. The problem therefore is to isolate the part of the nuclear energy which fluctuates due to shell effects. Shell corrections to the semi-classical evaluation of nuclear masses are formulated in terms of coherent states. (auth)

12856 FEATURES OF INELASTIC MONOPOLE TRANSITIONS AND THE EXCITATION OF A GIANT MONOPOLE RESONANCE. Morsch, H. P. (Minnesota Univ., Minneapolis (USA). John H. Williams Lab. of Nuclear Physics). Phys. Lett., B; 56: No. 2, 115-118(14 Apr 1975).

Inelastic monopole transitions are discussed in a shell model description. Basically there are two types of monopole transitions, (a) transitions to low lying states due to the mixing of spherical and deformed components in the nuclear ground state, and (b) higher energy 1p1h excitations. An estimate for the excitation strength of a possible giant monopole resonance is given. This microscopic calculation of the giant monopole resonance is in remarkable agreement with collective model predictions of Satchler. (auth)

12857 MESON–MESON INTERACTIONS AND THE EQUATION OF STATE FOR DENSE NUCLEONS. Canuto, V. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center); Datta, B. (City Coll., New York (USA). Dept. of Physics). Phys. Lett., B; 56: No. 2, 148-150(14 Apr 1975).

The effect of the interaction among mesons upon the equation of state for a high-density system of nucleons is studied, and it is found that such interactions do not significantly alter the asymptotic behavior of the equation of state. (auth)

12858 TIME-REVERSIBILITY VIOLATION AND ISOLATED NUCLEAR RESONANCES. Pearson, J. M. (Montreal Univ., Quebec (Canada). Lab. de Physique Nucleaire); Richter, A. (Technische Univ. Darmstadt (F. R. Germany). Inst. fuer Kernphysik). Phys. Lett., B; 56: No. 2, 112-114(14 Apr 1975).

It is pointed out that measurements of differential cross sections in nuclear reactions proceeding via an isolated resonance can provide in principle a test for time reversibility. (auth)

12859 SPONTANEOUS BREAKDOWN OF CP SYMMETRY, CABBIBO ANGLE IN NUCLEAR AND HYPERNUCLEAR PHYSICS. Suranyi, P.; Hedinger, R. A. (Cincinnati Univ., Ohio (USA). Dept. of Physics). Phys. Lett., B; 56: No. 2, 151-153(14 Apr 1975).

Following a suggestion of Salam and Strathdee that CP violation disappears and the Cabibbo angle vanishes at high magnetic fields it is inferred that no CP (or T) violation should be observed in nuclear beta decays and that stable hypernuclei are in principle possible. (auth)

12860 INFLUENCE OF ENERGETICS ON THE THRESHOLDS OF HEAVY ION TRANSFER REACTIONS. Gardes, D.; Bimbot, R.; Rivet, M. F. (Paris- 11 Univ., 91- Orsay (France). Lab. de Chimie Nucleaire); Fleury, A.; Hubert, F. (Bordeaux- 1 Univ., 33- Gradignan (France). Centre d'Etudes Nucleaires). J. Phys. (Paris), Lett.; 36: No. 3, L.59-L.63(Mar 1975).

The possibility of sub-barrier transfers is discussed from the point of view of the energetics of the reaction. The position of the entrance channel potential energy curve V_{iR} relative to that of the exit channel corrected for the mass balance $V_{fR} - Q_{gg}$ appears to be crucial. When the former curve is situated above the latter one, the transfer is energetically probable and will occur as soon as the colliding nuclei are sufficiently close to each other, i.e. for sub-barrier incident energies. Experimental examples are given. (auth)

12861 GENERATOR-COORDINATE METHODS IN NUCLEAR PHYSICS. Wong, C. W. (California Univ., Los Angeles (USA). Dept. of Physics). Phys. Rep.; 15: No. 5, 283-357(Jan 1975).

Generator-coordinate methods make use of variational parameters in microscopic or many-body wave functions to describe collective degrees of freedom. The use of these methods in

symmetry restoration, nuclear rotational and vibrational states is described. Numerical applications in various nuclear structure problems are briefly reviewed. The structure of the integral wave equation appearing in the method is briefly discussed. Applications of these methods to study nuclear reactions are reported. These methods permit microscopic descriptions of collective nuclear properties, especially in low-energy situations requiring the use of antisymmetrized wave functions. (auth)

12862 QUADRATIC SPIN-ORBIT FORCES AND THE DEUTERON MAGNETIC MOMENT. Sprung, D. W. L. (McMaster Univ., Hamilton, Ontario (Canada). Dept. of Physics). Nucl. Phys., A; 242: No. 1, 141-148(21 Apr 1975).

The contribution to the deuteron magnetic moment due to L-dependent components of the two-nucleon force is discussed, and evaluated for several potential models. The Reid soft core potential is expressed as a sum of central, tensor, spin-orbit, L^2 and Q_{12} forces, and it is argued that this choice of components has a number of advantages. (auth)

12863 MICROSCOPIC DESCRIPTION OF ISOSCALAR AND ISOVECTOR GIANT QUADRUPOLE RESONANCES. Bes, D. R. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)); Broglia, R. A. (State Univ. of New York, Stony Brook (USA). Inst. for Theoretical Physics); Nilsson, B. S. (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)). Phys. Rep.; 16: No. 1, 1-56(Jan 1975).

The Bohr-Mottelson model for isoscalar and isovector giant multipole particle-hole resonances is discussed in the framework of a separable multipole-multipole force and a single-particle harmonic oscillator potential. The quadrupole case is studied in detail. With the help of the RPA analytic expressions are obtained for energies, transition probabilities, effective charges and coupling constants. Special attention is paid to the coupling between isoscalar and isovector modes taking place in nuclei with $N \neq Z$. In particular, the consequences of such admixture for the inelastic scattering cross sections (particle-vibration vertices) and effective forces and charges are investigated. Calculations utilizing realistic single-particle levels are presented for different regions of the mass table and compared with the corresponding data. (auth)

12864 INTERMEDIATE-RANGE POTENTIAL AND THE $^1S_0$ NEUTRON–PROTON TRANSITION MATRIX. de Groot, H.; Boersma, H. J. (Vrije Universiteit, Amsterdam (Netherlands). Natuurkundig Lab.). Nucl. Phys., A; 242: No. 2, 253-264(28 Apr 1975).

The half-shell transition matrix t(p,k) for the singlet s-wave neutron-proton interaction has been studied for a class of partly non-local potentials. The potentials have been generated from the experimental phase shifts by using inverse scattering theory. The non-uniqueness of the inversion solution has been exploited to construct potentials with different short-range behavior. It is shown that the intermediate-range potential essentially determines t(p,k) for moments p and k both less than 2 fm^{-1}. Different short-range behavior is reflected in t(p,k) for larger momenta. The unknown high-energy phase shifts imply, however, comparable variations in that region even if the on-shell momentum k is small. The implications for nuclear structure calculations are discussed. (auth)

12865 ON THE DERIVATION OF EFFECTIVE INTERACTIONS BY MATRIX DIAGONALIZATION METHODS. Ellis, P. J. (Minnesota Univ., Minneapolis (USA). School of Physics and Astronomy). Phys. Lett., B; 56: No. 3, 232-236(28 Apr 1975).

A technique is developed which in certain cases allows the derivation of a completely linked two-body effective interaction for two particles beyond a closed shell using matrix diagonalization methods. In particular, this applies to a space consisting of 0 and 2 $\hbar\omega$ excitations. (auth)

12866 AN OPTICAL POTENTIAL FOR HEAVY ION INTERACTIONS. Jaqaman, H.; Mekjian, A. Z. (Rutgers–the State Univ., New Brunswick, N. J. (USA). Dept. of Physics). Phys. Lett., B; 56: No. 3, 237-240(28 Apr 1975).

An optical potential for nucleus–nucleus interactions is evaluated using a density-dependent effective two-body force. The resulting interaction potential is then used to discuss elastic scattering cross sections using a quarter-point recipe from Fresnel diffraction theory. Fits to quarter points of cross-sectional data are obtained with parameters for the effective interaction which fit properties of nuclear matter and with parameters for target and projectile densities obtained from electron scattering. (auth)

12867 ON THE INTERPRETATION OF THE OBSERVED HEAVILY DAMPED NUCLEAR COLLISIONS IN TERMS OF A CLASSICAL PHENOMENOLOGICAL DESCRIPTION. Deubler, H. H.; Dietrich, K. (Technische Univ. Muenchen, Garching (F. R. Germany). Physik-Dept.). Phys. Lett., B; 56: No. 3, 241-244(28 Apr 1975).

Deep inelastic heavy-ion collisions are investigated in a classical model including dissipative forces. In the dynamical calculation deformation degrees of freedom are taken into account explicitly. (auth)

12868 VARIATION OF THE GRAZING ANGULAR MOMENTUM WITH ENERGY AND DEVIATIONS FROM THE QUARTER-POINT RECIPE. Rowley, N.; Plagnol, E. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Phys. Lett., B; 56: No. 3, 221-224(28 Apr 1975).

The energy-dependence of the grazing angular momentum is given for a Saxon–Woods nuclear potential. Deviations from the "quarter-point recipe" are found and explained in terms of the optical model reflection coefficients and an optical model "deflection function". (auth)

12869 LANDAU PARAMETERS FOR NUCLEAR MATTER USING THE SKYRME INTERACTION. Baeckman, S. O.; Jackson, A. D.; Speth, J. (State Univ. of New York, Stony Brook (USA). Dept. of Physics). Phys. Lett., B; 56: No. 3, 209-211(28 Apr 1975).

Landau parameters for nuclear matter are calculated for several Skyrme interactions. Resulting values of G_0 and G_0' are in disagreement with empirical values and lead to instability against spin collapse in several cases. A suitable generalization of the interaction is suggested to overcome these difficulties. (auth)

12870 SPIN SATURATION AND THE SKYRME INTERACTION. Chang, B. D. (Argonne National Lab., Ill. (USA)). Phys. Lett., B; 56: No. 3, 205-208(28 Apr 1975).

Of existing variants of the Skyrme interaction, those with strong three-body terms — in particular the variant SIII, that is in best accord with experiment — overbind odd-mass nuclei and produce unstable spin-saturated Hartree–Fock ground states in nuclear matter and in even–even light nuclei. This difficulty can be removed either by imposition of an additional stability condition or by abandoning the three-body term in favor of the two-body density-dependent interaction equivalent to it in spin-saturated HF states. (auth)

12871 NUCLEAR PARAMETERS FROM IMPROVED PION–NUCLEUS OPTICAL POTENTIALS. Durand, G.; Gillespie, J. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). Phys. Lett., B; 56: No. 3, 263-265(28 Apr 1975).

Neutron and proton charge distributions are investigated for π–nucleus elastic, charge exchange, and double charge exchange scattering using modified Kisslinger optical potentials. Several variants of the potential are compared. (auth)

12872 PARTICLE SCATTERING ON THE NUCLEUS IN THE CASE OF NONLOCAL SEPARABLE INTERACTION. Vashakidze, I. Sh.; Chilashvili, G. A. (Tbilisi State Univ., USSR). Soobshch. Akad. Nauk Gruz. SSSR; 77: No. 3, 573-576(Mar 1975). (In Russian).

Particle scattering on the nucleus when the interaction between the incident particle and the nucleus is of nonlocal separable form was studied, and the elastic scattering matrix found. These results may be used in describing the processes of elastic and inelastic scattering of nucleons, π-mesons and other particles on the nuclei. (auth)

12873 EMPIRICAL ANALYSIS OF A FORMULA FOR THE BINDING ENERGY OF NUCLEI. Kolesnikov, N. N.; Vymyatnin, V. M. (Moscow State Univ.). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 12, 122-128(1974). (In Russian).

The semi-empirical formula of Bethe for the binding energy is improved by the systematic introduction of correction terms derived from experimental data. A minimum number of parameters are introduced, and it is required that the square of the deviation from the experimental value be a minimum for the binding energy. Coefficients are calculated from experimental data to take into account the distance from the stability line of the nuclei, the proximity to a magic number, and the number and type of nucleons present in the nucleus. This formula for the binding energy of nuclei in comparison with other formulas assures the best agreement with experimental values with the least number of parameters, especially for nuclei far from the line of beta-stability and for very heavy nuclei. Further improvement can be attained by introducing local shell corrections. (SJR)

12874 FADDEEV-TYPE EQUATIONS WITH HALF-OFF-SHELL INPUT. Karlsson, B. R.; Zeiger, E. M. (Stanford Linear Accelerator Center, CA). Czech. J. Phys.; 25: No. 3, 246-250(1975).

New Faddeev-type equations are derived for amplitudes directly related to the three-body transition amplitudes. They are simpler

than the usual Faddeev equations in that their effective potentials are independent of the energy and only require two-body state wave functions and half-off-shell amplitudes as input. Moreover, after an angular momentum decomposition, the potentials can easily be made real, and the breakup amplitudes explicitly exhibit a Watson final-state interaction factor. (auth)

12875 SOME REMARKS ON SELF-CONSISTENCY AND CORE POLARIZATION PHENOMENA IN NUCLEI. Zuker, A. P. (C. R. N., Strasbourg). Czech. J. Phys.; 25: No. 3, 311-324 (1975).

Isoscalar and isovector monopole polarizability are studied and shown to suggest naturally the idea of operator renormalization. The link with Hartree-Fock self-consistency is established, and an algebraic characterization and extension of the theory proposed. (auth)

12876 MANY-BODY FORCES IN EXACTLY SOLVABLE FIELD-THEORETICAL MODELS. Calogero, F. (Univ., Rome); De Santis, D. Czech. J. Phys.; 25: No. 3, 288-301(1975).

The forces acting among three, and more, baryons, are discussed, in the framework of the (exactly solvable) field theoretical models of Lee and of Wentzel. (auth)

12877 THE REDUCED WIDTH AMPLITUDE IN THE REACTION THEORY FOR COMPOSITE PARTICLES. Fliessbach, T. (Technische Univ. Muenchen, Garching (F. R. Germany). Physik-Department). Z. Phys., A.; 272: No. 1, 39-46(1975). 1 fig.; 21 refs.

The derivation of the reduced width amplitude (RWA) in the reaction theory for composite particles is investigated. This is done in the α-decay theory without loss of generality for the basic expressions. It is found that in a consistent theory one must only take into account the antisymmetrization—as it is usually done—but also to introduce a renormalization of basis states due to the antisymmetrization. This cannot be done by a normalization constant, but by a well defined normalization operator. A rough estimate of the effect of this renormalization is presented. (GE)

12878 SCISSION-POINT DISTRIBUTIONS IN LRA FISSION. Krishnarajulu, B.; Mehta, G. K. (Indian Inst. of Tech., Kanpur). Pramana.; 4: No. 2, 74-82(Feb 1975).

Trajectory calculations were performed using the three-point-charge model. The input parameters took values distributed over a wide range. Using experimental distributions, each trajectory was assigned a "weight"; and the trajectories and their statistical "weights" were used in obtaining initial distributions which in turn reproduced other experimental distributions, such as the angular distribution of α-particles, very well. Some information about the initial distributions was obtained. The effect of the anticorrelation, between the final α and fragment energies, on the initial distributions was examined. (auth)

PHYSICS (RADIATION AND SHIELDING)

Radiation Physics

Refer also to abstracts 11731, 11896, 12187, 12509, 12510, 12551, 12552, 12742, 12781, and 12788.

12879 RECOIL ESCAPE EFFICIENCIES AND RANGES OF ACTINIDE RECOILS FROM ACTINIDE TARGETS. Liukkonen, E.; Metag, V.; Sletten, G. (Niels Bohr Institutet, Copenhagen (Denmark)). Nucl. Instrum. Methods; 125: No. 1, 113-117(15 Mar 1975).

Escape efficiencies of recoiling Cm and Am nuclei with energies of 50 to 400 keV from Pu and Am targets have been measured. Recoil ranges for curium ions in plutonium and americium dioxide are deduced. The experimental results are compared with predictions of the Linhard, Scharff and Schiott theory. The calculated ranges are in reasonable agreement with the experimental values. (auth)

12880 ENERGY LOSS OF BETA PARTICLES ON BACKSCATTERING. Baltakmens, T. (National Radiation Lab., Christchurch (New Zealand)). Nucl. Instrum. Methods; 125: No. 1, 169-171(15 Mar 1975).

An empirical equation for calculating the effective maximum and average energy of beta particles after backscattering is derived from their absorption characteristics. For a beta emitter of maximum energy E_m and average energy $\bar{E}$, the effective maximum and average energies after scattering, E_s and $\bar{E}_s$, are given by $E_s/E_m = (158 + Z)/251$ and $\bar{E}_s/\bar{E} = (123 + Z)/216$, where Z is the atomic number of the scattering material. (auth)

12881 PLURAL AND MULTIPLE SCATTERING OF HEAVY IONS IN SOLIDS BY MONTE CARLO METHODS. Eastham, D. A. (Science Research Council, Daresbury (UK). Daresbury Nuclear Physics Lab.). Nucl. Instrum. Methods; 125: No. 2, 277-283(1 Apr 1975).

A classical form for the scattering of ions is evaluated using a Thomas–Fermi potential. This form is valid for large- and small-angle scattering, and is particularly suitable for Monte Carlo calculations of multiple scattering. Values for the small-angle multiple scattering in thin foils are computed and compared with other calculations. The use of computer simulations allows the direct evaluation of nuclear energy loss and straggling in thin foils. (auth)

12882 EXPERIMENTAL EVIDENCE FOR THE INFLUENCE OF THE ATOMIC SHELL STRUCTURE ON THE ENERGY LOSS OF HIGH ENERGY HEAVY IONS IN MATTER. Schmidt, K.-H.; Clerc, H.-G.; Wohlfarth, H.; Lang, W.; Lehmann-Carpzov, W. (Technische Univ. Darmstadt (F. R. Germany). Inst. fuer Kernphysik). Phys. Lett., B; 56: No. 3, 250-252(28 Apr 1975).

Secondary electron yield measurements for ^{252}Cf fission products in carbon foils reveal significant deviations for the electronic stopping cross section from semiempirical predictions. This effect may correspond to the Z_1 oscillations observed previously at much lower ion velocities. (auth)

12883 NEAR-THERMAL ENERGY WIDTH OF MODERATED HIGH ENERGY POSITRONS. Stein, T. S.; Kauppila, W. E.; Roellig, L. O. (Wayne State Univ., Detroit, Mich. (USA)). Phys. Lett., A; 51: No. 6, 327-329(7 Apr 1975).

More than 10^{-7} of the positrons emitted by ^{11}C (produced by proton bombardment of boron) emerge from the room-temperature boron target with a low energy (less than 1 eV) and a measured energy width of (0.100 + 0.010) eV. (auth)

12884 NEW DERIVATION OF THE TWO-MEDIA ORTHOGONALITY RELATIONS. Ishiguro, Y. (Instituto de Energia Atomica, Sao Paulo, Brazil). Trans. Am. Nucl. Soc.; 21: 234-235(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12885 INVARIANT COMPTON KERNELS FOR RADIATION TRANSPORT. Wienke, B. R. (Los Alamos Scientific Lab., NM). Trans. Am. Nucl. Soc.; 21: 528-529(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12886 IMPROVED MULTIGROUP REPRESENTATION OF DIFFERENTIAL COMPTON SCATTERING CROSS SECTIONS. Ward, J. T. Jr. (Westinghouse Hanford Co., Richland, WA). Trans. Am. Nucl. Soc.; 21: 529(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12887 COMPARISON OF RADIATION TRANSPORT IN ALTERNATING CONCRETE AND STEEL SLABS WITH A NEW BENCHMARK EXPERIMENT. Gordon, J. D.; Dresser, M. M. (TRW Systems, Redondo Beach, CA). Trans. Am. Nucl. Soc.; 21: 544-545(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12888 TRUNCATION ERRORS IN MOMENTS METHOD DISK SOURCE DOSE RATE CALCULATIONS. Trapp, T. J. Jr.; Rubin, R. M. (Mississippi State Univ., Mississippi State). Trans. Am. Nucl. Soc.; 21: 549-550(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12889 IMPROVED FORMULATIONS OF THE RESPONSE MATRIX METHOD. Filippone, W. L. (Lowell Technological Inst., MA). Trans. Am. Nucl. Soc.; 21: 550-551(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12890 ATOMIC COLLISIONS IN SOLIDS. Volume 2. Conference Held at Gatlinburg, Tennessee, September 24–28, 1973. Datz, S.; Appleton, B. R.; Moak, C. D. (eds.). New York; Plenum Publishing Corporation (1975). 476p. (CONF-730958-P2). $39.50.

Primary atomic collision processes, states of ions penetrating solids and their relation to macroscopic effects are covered. Sections included are: Electrons, Protons, and Channeling; Surface Scattering; Channeling; Dechanneling. 37 separate abstracts are included. (GHT)

For abstracts of individual papers see: 12508–12514, 12549–12552, 12788, and 12891–12915.

12891 RADIATIVE ELECTRON CAPTURE BY CHANNELED OXYGEN IONS. Appleton, B. R. (Oak Ridge National Lab., TN); Noggle, T. S.; Moak, C. D.; Biggerstaff, J. A.; Datz, S.; Krause, H. F.; Brown, M. D. pp 499-507 of Atomic Collisions in Solids. Vol. 2. Datz, S. (ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

Results of investigations of the radiative electron capture phenomenon for 17.8 to 40.0 MeV ^{16}O ions channeled through thin Ag single crystals along the 110 axial direction are reported. The advantages of using channeled ions, rather than ions bombarding amorphous or polycrystalline solids is pointed out. (3 figures) (GHT)

12892 EMISSION OF ELECTRONS AND POSITRONS FROM CRYSTALS: DIRECTIONAL EFFECTS. Pathak, A. P. (Atomic Energy Research Establishment, Harwell). pp 531-537 of Atomic Collisions in Solids. Vol. 2. Datz, S. (ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

The wave mechanical treatment of directional effects in the emission of the electrons and positrons from crystals as described earlier has been used to calculate the detailed emission patterns. The Moliere approximation to the Thomas-Fermi potential is used to describe the atomic interaction potential. Single phonon approximation for inelastic phonon scattering and Debye model for lattice vibrations have been used. Within the framework of two beam theory, the effects of phonon absorption are illustrated by comparing the emission pattern for different crystal thickness traversed by the particles. The results are in qualitative agreement with experiments. The angular widths of emission patterns agree with earlier calculations. (auth)

12893 CHANNELING OF 25-MeV POSITRONS AND ELECTRONS. Neufert, A.; Schiebel, U.; Clausnitzer, G. (Inst. fuer Kernphysik, Giessen, Ger.). pp 539-546 of Atomic Collisions in Solids. Vol. 2. Datz, S. (ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

Channeling effects of 25 MeV positrons and electrons in MgO-single-crystals were measured. The influence of string scattering on the transmission profiles is discussed as a function of crystal thickness. (7 figures) (auth)

12894 CHANNELING-BLOCKING EFFECT OF ENERGETIC ELECTRONS. Fujimoto, F.; Komaki, K.; Fujita, H.; Sumita, N.; Uchida, Y.; Kambe, K.; Lehmpfuhl, G. (Univ. of Tokyo). pp 547-554 of Atomic Collisions in Solids. Vol. 2. Datz, S. (ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

The blocking effect of electrons with high energy is observed by using the convergent-beam technique of electron diffraction and the electron microscopic images. The spot- and ring-like peaks inside the blocking dip are observed and are explained by the dynamical and classical theories. (7 figures) (auth)

12895 COHERENT PHOTON EMISSION BY FAST PARTICLE EXCITED ATOMS IN ELECTROMAGNETIC FIELD. Riazanov, M. I. (Moscow Physical-Engineering Inst.). pp 555-557 of Atomic Collisions in Solids. Vol. 2. Datz, S. (ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

A particle moving in a substance continuously excites the atoms with which it collides. A method is presented which permits the calculation of coherent photon emission by excited atoms in electromagnetic fields. (GHT)

12896 EFFECT OF THE LEVELS OF THE TRANSVERSE MOTION OF ELECTRONS ON THE ELECTROMAGNETIC PROCESSES IN MONOCRYSTALS. Kalashnikov, N. P.; Koptelov, E. A.; Riazanov, M. I. (Moscow Physical-Engineering Inst.). pp 559-565 of Atomic Collisions in Solids. Vol. 2. Datz, S. (ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

The orientational dependence of the elastic scattering of fast nonrelativistic electrons in monocrystals has been investigated when the energy of transverse motion (E/sub perpendicular to/ equals E theta$_0^2$) is smaller than the energy of the "bound" state of the atomic plane. The presence of the "bound" state of transverse motion in the effective attractive potential of the crystallographic planes leads to the radiation gamma-quantum when the electron transits into the discrete spectrum state. This effect is responsible for the production of the orientational maxima in the bremsstrahlung spectrum of nonrelativistic electrons. (auth)

12897 SURFACE SCATTERING OF LOW ENERGY IONS. Heiland, W.; Schaeffler, H. G.; Taglauer, E. (Max-Planck-Inst. fuer Plasmaphysik, Garching, Ger.). pp 599-609 of Atomic Collisions in Solids. Vol. 2. Datz, S. (ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

Angular and energy distributions of Ne^+ ions (200 eV to 2 keV) backscattered from Ni(110) and (111) surfaces were measured and compared with numerical calculations. In the energy distribution peaks due to multiple and single scattering events can be identified. Multiple scattering occurs between a minimum and a maximum scattering angle. Experimentally, both angles depend on the lattice parameters, the angle of incidence, the energy and the ion-atom combination. These effects are qualitatively understood in the atomic chain model of multiple scattering. The main discrepancies between model and experiment are slight shifts of the measured energies towards lower values and deviations of the maximum scattering angle towards higher values. The angular deviation can be accounted for by fitting the screening length in the Moliere approximation of the Thomas-Fermi potential, which was used for the calculations. The screening length thereby obtained is about 30 percent below the theoretical value of Lindhard. A comparison with other potentials from the literature indicates that the potential determined here is within theoretical expectations. (8 figures, 16 references) (auth)

12898 HYPERCHANNELING. Barrett, J. H. (Oak Ridge National Lab., TN); Appleton, B. R.; Noggle, T. S.; Moak, C. D.; Biggerstaff, J. A.; Datz, S.; Behrisch, R. pp 645-668 of Atomic Collisions in Solids. Vol. 2. Datz, S. (ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

Improved measurements of [011] hyperchanneling in Ag are reported, and the first results for hyperchanneling along a second direction, [001], in Ag are given. The theory outlined is based on the assumption of statistical equilibrium and has been shown to provide an adequate basis for understanding the general features of hyperchanneling. These general features include the main peak, the transition peak associated with phi/sub h/, the variation of these peaks as the crystal is tilted, and the relative values of phi/sub h/ for the [001] and [011] axes. For [001] hyperchanneling, additional group structure appears in the energy loss spectra in addition to the basic structure described by the statistical equilibrium theory. The most likely explanation of the extra groups appears to be the wave effects of the kind observed for planar channeling. The values of the two parameters, phi/sub h/ and epsilon/sub A/, that have been adjusted to give best agreement of theory with experiment are higher than the estimated values. However they are closer to the estimated values than those obtained by a similar adjustment for best fit to earlier experiments. This is attributed to improvements in the experimental apparatus, measurement procedures, and specimen evaluation. (12 figures, 15 references) (GHT)

12899 CHANNELING STUDIES OF ALKALI HALIDES. Price, P. B.; Kelly, J. C. (Univ. of New South Wales, Australia). pp 669-679 of Atomic Collisions in Solids. Vol. 2. Datz, S. (ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

Angular scans of a number of alkali halides have been carried out using low (less than 10^{13} ions cm^{-2}) doses for each point to give approximately "zero dose" psi/sub 1/2/ values. The effects of increasing dose on chi/sub min/ are reported for beams of H^+, D^+, and He^+ on a number of alkali halides up to a maximum dose of 10^{17} ions cm^{-2}. (6 figures, 15 references) (GHT)

12900 MOLECULAR ION TRANSMISSION THROUGH A MONOCRYSTALLINE THIN FILM. Gaillard, M. J.; Poizat, J. C.; Remillieux, J. (Univ. Claude Bernard, France). pp 681-692 of Atomic Collisions in Solids. Vol. 2. Datz, S. (ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

We have observed the channeling effects on the transmission of H_2^+ molecular ions through thin gold crystals. Energy and thickness dependences have been tested in planar channeling conditions. Similarly, the production of H_2^+ ions from an incident H_2^+ beam has been studied. All these observations are consistent with a molecular recombination taking place at the back surface of the crystal. (6 figures) (auth)

12901 FLUX PEAKING, DECHANNELING CROSS SECTION, AND DETECTION PROBABILITY IN CHANNELING AND BLOCKING EXPERIMENTS FROM COMPUTER SIMULATIONS AND ANALYTICAL MODELS. Pabst, H. J. (Univ. of Sussex, Eng.). pp 717-734 of Atomic Collisions in Solids. Vol. 2. Datz, S. (Ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

Results and interpretations are presented of computer simulation calculations of the channeling and the blocking effect for light energetic ions in the (110) channel of silicon. Oscillations of hyperchanneled ions were detected in the case of channelling. The rule of reversibility is shown to apply for channeling and blocking with equating initial beam divergence and detector acceptance angle. The dechanneling cross section by defects is shown not to be constant over the channel area. Applicability of analytical models and implications for the analysis of experiments are discussed. (6 figs, 23 refs) (auth)

12902 CHANNELING, BLOCKING, AND RANGE MEASUREMENTS USING THERMAL NEUTRON INDUCED REACTIONS. Biersack, J. P.; Fink, D. (Hahn-Meitner Inst., Berlin). pp 737-747 of Atomic Collisions in Solids. Vol. 2. Datz, S. (Ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

A method for detecting depth distributions and lattice locations of light atoms in crystalline environments is described. The method utilizes MeV protons, tritons or alpha particles emitted after the capture of thermal neutrons. The method is demonstrated for low concentrations of ^{6}Li and ^{10}B in ionic crystals, semiconductors, and metals. Range profiles of lithium incident on niobium and silver with an energy of 220 keV are measured and are found to agree with the theoretically predicted Edgeworth expansion. (GHT)

12903 DOUBLE PLANAR ALIGNMENT SCATTERING WITH A VERY THIN CRYSTAL. Gaillard, M. J. (Univ. Claude Bernard, France); Poizat, J. C.; Remillieux, J.; Abel, F.; Bruneaux,

M.; Cohen, C. pp 779-790 of Atomic Collisions in Solids. Vol. 2. Datz, S. (Ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

Variations with incident energy of the scattering yield of H^+ and He^+ ions, measured in a particular configuration of planar double alignment, have been observed. The structure of these variations is related to the oscillating nature of the trajectories of the ions in planar channeling. Experimental oscillation lengths are deduced for H^+ and He^+ ions in the (111) direction, and for H^+ ions in the (110) direction. Calculations are presented in which the stochastic model of Abel et al., describing the scattering probability in single alignment conditions, has been extended to the double alignment geometry. (9 figs) (auth)

12904 AXIAL AND PLANAR CHANNELING IN TiO/sub x/ SYSTEM. Della Mea, G. (Univ., Padua); Drigo, A. V.; Lo Russo, S.; Mazzoldi, P.; Yamaguchi, S.; Bentini, G.; Desalvo, A.; Rosa, R. pp 791-810 of Atomic Collisions in Solids. Vol. 2. Datz, S. (Ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

The channeling study of TiO/sub x/ crystals with different oxygen concentration has been performed. In this system oxygen atoms distribute in the octahedral interstitial sites of the h.c.p. metal lattice. The effect of the titanium and oxygen sublattice were separated by observing both the deuteron spectra backscattered from the titanium sublattice and the proton yield from the $^{16}O(d,p)^{17}O^*$. The results concerning the channeling half angle are in satisfactory agreement with the theoretical predictions of Barrett. In the (0001) and (10$\bar{1}$0) planes, which consist entirely of titanium or oxygen atoms, flux-peaking effect in the yield of the nuclear reaction was always observed and this effect decreases with increasing oxygen concentration. The axial channeling results for ten atomic percent of oxygen display a weak flux-peaking effect, while at higher concentrations the angular dip of the oxygen sublattice is observed. A Monte Carlo program to simulate the effect of the interstitial impurities has been tried for a silicon crystal with increasing boron concentration. The results concerning the influence of the interstitial concentration on flux-peaking or channeling are in qualitative agreement with the experimental results in TiO/sub x/ h.c.p. structure. (7 figs, 27 refs) (auth)

12905 ENERGY DEPENDENCE OF THE SURFACE MINIMUM YIELD FOR AXIAL CHANNELING. Della Mea, G. (Univ., Padua); Dringo, A. V.; Lo Russo, S.; Mazzoldi, P.; Cornara, G.; Yamaguchi, S.; Bentini, G. G.; Cembali, G.; Zignani, F. pp 811-817 of Atomic Collisions in Solids. Vol. 2. Datz, S. (Ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

The energy dependence of the axial channeling minimum yield has been investigated in diamond type structure using silicon (110) and germanium (111) crystals. Experimental results have been compared with the Monte Carlo results obtained by Barrett. The energy dependence of surface minimum yield was observed and found in satisfactory agreement with the Barrett's predictions. The effective number of surface layers has been evaluated. (4 figs) (auth)

12906 EXPERIMENTAL STUDY AND STOCHASTIC INTERPRETATION OF OSCILLATORY EFFECTS IN BACKSCATTERING SPECTRA IN PLANAR CHANNELING. Abel, F.; Amsel, G.; Bruneaux, M.; Cohen, C. (Univ., Paris). pp 819-823 of Atomic Collisions in Solids. Vol. 2. Datz, S. (Ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

Backscattering experiments with 1.9 MeV He ions were performed to study the oscillating trajectories of particles in planar channels of iron crystals. Strong maxima in planar aligned spectra are observed. Spectra registered for particles entering the crystal with angles of incidence with respect to the plane greater than the critical angle also exhibit strong maxima. Calculations which do not take into account multiple scattering predict qualitatively the experimental results. In order to obtain a quantitative agreement a stochastic model which accounts for the effects of multiple scattering is proposed and yields very good fits to the experimental results. (auth)

12907 INTERSTITIAL ATOM LOCATION IN SILICON BY SINGLE AND DOUBLE ALIGNMENT BACKSCATTERING OF MeV HELIUM IONS. Morita, K.; Carstanjen, H. D. (Univ., Munich). pp 82-837 of Atomic Collisions in Solids. Vol. 2. Datz, S. (Ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

Single alignment and double alignment backscattering of helium ions from silicon have been simulated on a computer model. The dependence of the backscattering yield profiles on the tilt plane is examined for single alignment along [110] and the (110), (111), and (100) tilt planes for 2.1 MeV helium ions with a beam divergence of 0.04^0. For off axis interstitial sites, maxima in the yield profiles are found at angles which are are characteristic of the particular site. In double alignment, the yield profiles of 2.8 MeV helium ions backscattered from a silicon crystal with 5×10^{-3} interstitial silicon atoms per lattice atom are calculated for the combinations: [110] incidence channeling, [1$\bar{1}$0] blocking direction with detector tilt in (110) and [$\bar{1}$00] blocking direction with detector tilt also in (011). The former combination is sensitive to tetrahedral, hexagonal, and Yb positions and the latter to hexagonal. The lowest interstitial concentration to be detected is estimated to be 10^{-3}. The efficiency of the double alignment in determining the configuration of lattice defects is compared with that of single alignment. (6 figs, 14 refs) (auth)

12908 AXIAL DECHANNELING. I. A Theoretical Study. Schiott, H. E.; Bonderup, E.; Andersen, J. U.; Esbensen, H. (Univ. of Aarhus, Denmark). pp 843-862 of Atomic Collisions in Solids. Vol. 2. Datz, S. (Ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

A continuation of previous theoretical work on axial dechanneling is described. A diffusion equation, in which the diffusion function is strongly dependent on transverse energy, accounts for the change with depth of the transverse energy distribution. In our previous work the calculated minimum yields were typically a factor of 2 to 3 too low. In this paper we have evaluated the diffusion function more carefully and found it necessary to introduce changes in both the electronic and the thermal components. Theoretical predictions agree quite well with backscattering experiments on Si and W and with transmission experiments on Si. The merits and limitations of the simple model using a steady increase in transverse energy are illustrated by a comparison of full angular scans obtained from the simple model, and from the diffusion equation. Finally, the application of the diffusion equation to the analysis of blocking dips, obtained for the determination of lifetimes of compound nuclei, is described. (6 figs, 11 refs) (auth)

12909 AXIAL DECHANNELING. II. An Experimental Study. Pedersen, M. J.; Andersen, J. U.; Elliott, D. J.; Laegsgaard, E. (Univ. of Aarhus, Denmark). pp 863-875 of Atomic Collisions in Solids. Vol. 2. Datz, S. (Ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

The dechanneling caused by multiple scattering was investigated by measuring, as a function of penetration depth, the minimum yield of Rutherford backscattering for MeV protons incident parallel to an axis on various crystalline targets. The results are compared to theoretical calculations. Good agreement is obtained with calculations for Si and W, indicating the essential features of the dechanneling process are included in the theoretical description. (9 figs, 13 refs) (GHT)

12910 DECHANNELING AND RECHANNELING CALCULATIONS. Edge, R. D.; Murphree, Q. C. (Univ. of South Carolina, Columbia). pp 877-889 of Atomic Collisions in Solids. Vol. 2. Datz, S. (Ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

A computer calculation has been completed giving the angular distribution of protons scattered off a string of gold atoms in the (110) orientation in the vicinity of the critical channeling angle under the assumption of the impulse approximation. The distributions indicate how ions leave and enter the channel. It can be seen, from the angular distribution patterns, that the collective effect of the string extends well beyond the usual region of channeling. The angular distributions as a function of the angle of incidence on the string may be employed to determine a diffusion coefficient and a flux coefficient to solve a diffusion equation for the flux of particles into and out of the channel. The steady state solution is presented to show that there is a slight decrease in density just outside the usual channeling region, and that there is an appreciable density within the channel only if thermal vibrations are included. (11 figs, 21 refs) (GHT)

12911 MODIFIED DECHANNELING THEORY AND DIFFUSION COEFFICIENTS. Kitagawa, M.; Ohtsuki, Y. H. (Waseda Univ., Tokyo). pp 891-896 of Atomic Collisions in Solids. Vol. 2. Datz, S. (Ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

A modified diffusion equation is derived from the generalized Fokker-Planck equation. In the modified equation, damping effects and two-directional diffusion coefficients are included. It is concluded that the damping effect may not be neglected for dechanneling, especially for the study of ion mass effect. Dechanneling rate is shown for 1.5 MeV $^{1}H^{+}$, $^{2}D^{+}$ and $^{4}He^{+}$ ions in the Ge (100) axis. (GHT)

12912 INELASTIC SCATTERING IN CHANNELING. Ohtsuki, Y. H. (Waseda Univ., Tokyo). pp 897-903 of Atomic Collisions in Solids. Vol. 2. Datz, S. (Ed.). New York; Plenum Publishing Corporation (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

The role of inelastic scattering in channeling is pointed out. Local transition probability from the localized incident wave is considered and averaged according to the channeling path. Local transition probability, backscattering yield, local diffusion coefficient and local stopping power are calculated. (4 figures) (GHT)

12913 CHANNELING IN A NONPERFECT CRYSTAL. Campisano, S. U.; Foti, G.; Grasso, F.; Rimini, E. (Univ. di Catania, Italy). pp 905-917 of Atomic Collisions in Solids. Vol. 2. Datz, S. (Ed.). New York; Plenum Publishing Corp. (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

A dechanneling treatment, previously developed for perfect crystals and for those covered with amorphous layers, is extended to the case of a damaged crystal. The minimum yield and the angular yield profiles have been measured in Si damaged by 0.3 MeV deuterons as a function of penetration depth by backscattering of MeV deuterons. In the case considered, i.e., low defect concentration, the aligned yield at a given depth results from wide-angle scattering on defects lying at the same depth, which adds to the dechanneled fraction. The last depends on the concentration of defects, which being spread inside the crystal contribute to multiple scattering in the channel as electrons and thermal vibrations do. The defect contribution should then be added to the electronic and nuclear reduced multiple scattering. The dechanneled fraction has been obtained in the steady increase approximation as a function of the experimental parameters and of the defect concentration and profile. The comparison of the calculated minimum yield with experiments shows an extremely good agreement. (auth)

12914 TRANSMISSION ENERGY SPECTRA OF CHANNELED PROTONS SCATTERED IN THIN SILICON FILMS. Eisen, F. H.; Bottiger, J. (Rockwell International, Thousand Oaks, CA). pp 919-927 of Atomic Collisions in Solids. Vol. 2. Datz, S. (Ed.). New York; Plenum Publishing Corp. (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

The transmission energy spectra of 0.2 and 0.4 MeV protons, scattered from thin (approximately 1 mu m) silicon crystals, have been studied as a function of sample orientation, with and without the introduction of a thin layer of disorder produced by implanting krypton ions. From a comparison of spectra observed for undamaged samples for random penetration and for channeling along the (110) axis with scattering angles of 10^{0} and 15^{0}, it is concluded that the energy loss of dechanneled protons is approximately equal to the random energy loss. It is argued that the protons observed in the defect spectrum are scattered from interstitials lying more than a few tenths of an angstrom off lattice sites. The number of such interstitials is compared with the number of scattering centers observed in a standard backscattering-channeling effect measurement on the same portion of the sample. It is concluded that the channeling effect technique, using backscattering, is primarily sensitive to such interstitials. (4 figures) (GHT)

12915 INTERFERENCE DECREASE OF ELASTIC SCATTERING OF FAST CHARGED PARTICLES IN SINGLE CRYSTALS. Kalashnikov, N. P.; Koptelov, E. A.; Riazanov, M. I. (Moscow Physical Engineering Inst.). pp 929-934 of Atomic Collisions in Solids. Vol. 2. Datz, S. (Ed.). New York; Plenum Publishing Corp. (1975).

From 3rd international conference on atomic collisions in solids; Gatlinburg, Tennessee, USA (23 Sep 1973). See CONF-730958-P2.

The elastic scattering of a fast particle in an atom at high energy is treated as diffraction, wherein there appears a diffraction shadow whose blackness depends on the particle interaction with the atom. Calculations are presented to account for the shadowing effect in crystals. (GHT)

12916 TEMPERATURE-DEPENDENT PLANAR POTENTIAL FOR CHANNELING. Quere, Y. (CEN, Fontenay-aux-Roses, France). Phys. Rev., B.; 11: No. 5, 1818-1822(1 Mar 1975).

By effectively thickening the atomic planes, thermal agitation alters the potential between a plane and a channeled particle as evaluated by Lindhard in the "rigid" case. The influence of temperature on this "planar potential" was calculated and the following universal expression derived: V/sub T/(x) equals $9.0Z_1Z_2e^2N/sub\ p/a(u/sub\ T/ + 0.55)/sup\ 1/3/[1 + (0.17u/sub\ T/ + 0.36/u/sub\ T/ + 0.30)\ x/sup\ 1.255-4.35\ x\ 10^{-2}\ (u/sub\ T/-1.77)/sup\ beta/]/sup\ -1/$, x is the distance to the geometrical plane, u/sub T/ is the thermal root mean amplitude, both in units of Thomas-Fermi screening radius a, Z_1 and Z_2 are the atomic numbers of the target and the particle, and N/sub p/ is the atomic density of the plane along which channeling is considered. (auth)

Radiation Protection Standards

Refer also to abstract 11724.

Radiation Source Calibration and Standardization

Refer also to abstract 12836.

12917 MEASUREMENTS OF DISINTEGRATION RATES OF ^{125}I SOURCES WITH A SINGLE WELL-TYPE NaI(Tl) DETECTOR. Horrocks, D. L. (Beckman Instruments, Inc., Fullerton, Calif. (USA)). Nucl. Instrum. Methods; 125: No. 1, 105-111(15 Mar 1975).

A calibrated ^{125}I source was employed to check the x-ray–x-ray coincidence method for determining the ^{125}I absolute activity. The method was shown to be applicable to extended sources, provided all parts of the sample were counted with the same efficiency. This simple method was shown to be useful in calibrating other ^{125}I sources. Once calibrated the source could be used to determine the counting efficiency of any detector system. (auth)

12918 A METHOD FOR ACCURATELY DETERMINIG THE THICKNESS DIMENSIONS AND PHOTON-INTENSITY CORRECTIONS OF A THICK, COVERED, PHOTON SOURCE. Gallagher, W. J.; Cipolla, S. J. (Creighton Univ., Omaha, Nebr. (USA)). Nucl. Instrum. Methods; 125: No. 2, 269-276(1 Apr 1975).

A method is presented for determining the thickness dimensions of a thick, covered, extended source for the purpose of accurately calculating photon-intensity corrections for such a source. The method involves measuring the intensities of photon emissions from the source using a high-resolution Si(Li) detector, finding the intensity attenuation by comparison with a small, thin, uncovered source, and fitting the relative absorption to a model that has the thickness dimensions as parameters to be estimated. The application of the procedure to an ^{241}Am source in a particular geometry is described, and the results are presented. In an appendix an approximation is developed for obtaining the solid angle subtended by a cylindrical aperture at a point source. The approximation is reasonably accurate when the dimensions of the cylinder are small compared with the source-aperture separation. (auth)

Shielding Calculations and Experiments

Refer also to abstracts 12279, 12731, 12741, 13232, 13233, and 13619.

12919 PERTURBATION THEORY AND SENSITIVITY ANALYSIS FOR TWO-DIMENSIONAL SHIELDING CALCULATIONS. Childs, R. L.; Bartine, D. E.; Engle, W. W. Jr. (Oak Ridge National Lab., TN). Trans. Am. Nuc. Soc.; 21: 543-544(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12920 EFFECTS OF AMBIENT FIELD SPECIFICATION ON INITIAL RADIATION DOSE IN CONCRETE STRUCTURES. Beer, M.; Cohen, M. O. (MAGI, Elmsford, NY). Trans. Am. Nucl. Soc.; 21: 545-546(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

PHYSICS (THEORETICAL)

General

12921 (EFI-51(74)) ON AN APPROACH TO FEYNMAN FORMULATION OF QUANTUM MECHANICS. Gol'dman, I. I. (Erevanskij Fizicheskij Inst. (USSR)). 1974. 12p. (In Russian). INIS.

A look is taken at two methods of assigning functions q(t), p(t), which determine motion, by dividing the interval (t',t'') into a large number of intervals while assigning values of the functions q and p in each interval and by assigning their Fourier components. A calculation is made of the amplitude renormalization because of the different description of the higher harmonics in these two approaches. It is shown that the description of the initial and final state has an effect on the selection of the action expression. The most adequate description of the state of the system is obtained if the momenta and coordinates at the beginning and end of the process are considered to be commutative. (SJR)

12922 (EFI-52(74)) FIELD INTEGRALS AND OPERATOR DESCRIPTION OF INITIAL AND FINAL STATES IN QUANTUM MECHANICS OF IDENTICAL PARTICLES. Gol'dman, I. I. (Erevanskij Fizicheskij Inst. (USSR)). 1974. 14p. (In Russian). INIS.

A symbolic expression is revealed for the amplitude of a process in quantum mechanical, field theory. The action equation is represented in a form assuring convergence of integrals according to possible states, and independence of the amplitude from the method of dividing up the time interval. A set of equations are established connecting Green's function G with corresponding, connecting functions K, and an exponential representation of the amplitude through the latter. For describing the initial and final states an operator approach is used. It is natural to consider the operators, which refer to the initial and final periods of time, as commutating or anticommutating without real parts. (SJR)

12923 (JUL-1124-MA) ON THE APPLICATION OF APPROXIMATION BY FINITE POINT SETS ON THE SOLUTION OF INTEGRAL-DIFFERENTIAL EQUATIONS. Wick, J. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Zentralinstitut fuer Angewandte Mathematik). Oct 1974. 25p. (In German). INIS.

A summary is given of theoretical relations, given in former work to the problem named in the title. Then the transformation of initial conditions on the equipartition and an as good as possible approximation for equipartition is sought, and finally numerical results are discussed for the case of the Vlasov equation. (RW)

12924 (RL-75-009, pp I.70-I.107) DIRAC EQUATION. Jones, G. T. (Univ. of Birmingham, Eng.). 1975.

In proceedings of the 1974 school for young high energy physicists.

The lecture deals with: the Lorentz transformation; vectors and tensors; the Dirac equation (the γ-matrices, representation of Dirac matrices, does the Dirac equation describe any experimental results, invariance of the Dirac equation, what is S for finite Lorentz transformation, solutions to the Dirac equation, projection operators, interpretation of negative energy states, covariant bilinear forms). (UK)

12925 SUPERFIELD DENSITIES AND ACTION PRINCIPLE IN CURVED SUPERSPACE. Arnowitt, R.; Nath, P. (Northeastern Univ., Boston, Mass. (USA). Dept. of Physics); Zumino, B. (Harvard Univ., Cambridge, Mass. (USA). Lyman Lab. of Physics). Phys. Lett., B; 56: No. 1, 81-84(31 Mar 1975).

The concept of determinant is generalized to superspace. Density superfields are defined, and the metric density is obtained. This is used to construct an invariant action principle in curved superspace. (auth)

12926 A DIAGRAMMATIC INTERPRETATION OF FORMAL RAYLEIGH-SCHROEDINGER PERTURBATION THEORY. Kvasnicka, V. (Slovenska Vysoka Skola Technicka, Bratislava (Czechoslovakia)). Chem. Phys. Lett.; 32: No. 1, 167-172(1 Apr 1975).

A diagrammatic interpretation of the formal (i.e., without second quantization formalism) quasi-degenerate Rayleigh-Schroedinger perturbation theory with non-hermitian model hamiltonian is suggested. In this approach, the diagrammatic expressions for the Bloch wave operator U as well as for the model interaction operator G_{RS} are obtained. In the framework of the suggested graphology it is possible to perform a detailed study of the algebraic structure of individual perturbation contributions. The present diagrammatic approach has some general features of Brandow's folded-diagram method initially introduced in order to construct the many-body degenerate Rayleigh-Schroedinger perturbation theory. (auth)

12927 A NEW METHOD FOR EVALUATING GAUSSIAN PATH INTEGRALS. Goovaerts, M. J. (Rijksuniversitair Centrum te Antwerpen (Belgium)). Physica; 77: No. 2, 379-389(15 Oct 1974).

A new method for evaluating the path integral corresponding to the harmonic oscillator with time-dependent frequency $\Omega(t)$ and acted on by a time-dependent perturbative force is given. The advantage of the present method consists in the fact that the analytical expression for this path integral can immediately be expanded as a series in the eigenfunctions of the corresponding Schroedinger equation. (auth)

12928 DIRAC'S HAMILTONIAN FORMALISM AND GAUGE-INVARIANT CLASSICAL ELECTRODYNAMICS. Vardalas, J. (Brussels Univ. (Belgium). Faculte des Sciences). Physica; 77: No. 2, 431-439(15 Oct 1974).

Using Dirac's method of constraints the problem of a gauge-invariant hamiltonian formulation of a relativistic plasma is studied. In particular a hamiltonian formulation is obtained strictly in terms of the electric and magnetic fields, and the mechanical momenta of the particles. The explicit Lie-bracket relations between the fundamental microscopic variables is no longer canonical. These Lie-bracket relations and the equations of motion are given by Dirac's modified Poisson bracket. (auth)

12929 ON THE RELATION BETWEEN PEIERLS' PERTURBATION THEORY FOR PROJECTED STATES AND EXCHANGE PERTURBATION THEORY. Mann, A. (Technion-Israel Inst. of Tech., Haifa. Dept. of Physics). Chem. Phys. Lett.; 32: No. 2, 363-364(15 Apr 1975).

The derivations of a rather general class of exchange perturbation theories (or symmetry-adapted perturbation theories) and Peierls' perturbation theory for projected states are discussed. While the approaches are different, the equivalence of the resulting formalisms is established. (auth)

12930 CONTINUOUS SYSTEMS IN ONE-DIMENSIONAL STATISTICAL QUANTUM MECHANICS WITH AN INFINITE RANGE INTERACTION. Souhov, I. (Institut des Hautes Etudes Scientifiques, 91- Bures-sur-Yvette (France)). Compt. Rend., Ser. A, B; 279: No. 11, 433-434(9 Sep 1974). (In French).

Limits objects such as Gibbs state and Green functionals are built for a class of continuous quantum systems in one-dimensional statistical mechanics. (auth)

12931 ON DIFFERENT RANDOM PROCESSES OF STOCHASTIC QUANTUM MECHANICS. Claverie, P.; Diner, S. (Paris-6 Univ., 75 (France). Inst. de Biologie Physico-Chimique). Compt. Rend., Ser. A, B; 280: No. 1, 1-14(6 Jan 1975). (In French).

Three kinds of random processes simulating the behavior of quantum systems are compared: the Nelson-La Pena-Auerbach process, the parastochastic process and the stochastic electrodynamics process. This last one gives for the harmonic oscillator a synthesis of properties (ergodicity and quasiperiodicity) which are physically desirable, and appear separately in the first two processes. (auth)

12932 SUPERPOSITION OF FLUCTUATIONS OF VARIOUS TIME CONSTANTS: FORMULATION. Weil, J. W. (Univ., Innsbruck). Acta Phys. Acad. Sci. Hung.; 37: No. 1-2, 165-170(1974). (In German).

Following up Landau and Lifshits's statement on the potential establishment of a "hierarchy" of fluctuations of time constants, involving the relaxation of local equilibria disturbed by the transmission of sound and heat, an attempt was made to develop a generalized scheme of such a hierarchy of "thermodynamic" and "microscopic" fluctuations. Space-independent, local canonical general distribution was used as the starting point for the development of a simplified model to obtain relevant average values. It was assumed that a small, linear variable field is superposed onto a constant temperature. Although such simplified values are difficult to obtain, it was still considered of interest to use even an unrealistic model for deriving the laws which govern particle correlations. (TTT)

12933 DEGENERATE-KERNEL BOLTZMANN DISTRIBUTION FUNCTIONS ON $R^p \otimes U^p$. Syros, C. (European Atomic Energy Community, Brussels). Nuovo Cim.; 25B: No. 1, 315-327(11 Jan 1975).

By means of the structural properties of the Boltzmann operator exact elementary solutions were constructed for degenerate kernels in p-dimensional spaces. The property of the streaming operator

$v \cdot \nabla + v\sigma(v)$ to map a certain class of functions $\psi(x,v)$ defined on a subset of $R^p \otimes U^p$ onto another class of functions $\varphi(x)$ defined on R^p allows one to algebraize the method of solving the transport equation and the determination of the eigenvalue spectrum. (auth)

12934 ON A VARIATIONAL–PERTURBATIONAL METHOD FOR LARGE PERTURBATIONS. Schoenhammer, K.; Cederbaum, L. S. (Technische Univ. Muenchen, Garching (F. R. Germany). Physik-Dept.). Phys. Lett., A; 51: No. 6, 325-326(7 Apr 1975).

By use of a perturbation theoretical argument, an effective variational ansatz for the ground state is given. The formula works for arbitrary coupling strengths. The anharmonic oscillator is presented as an example, and a comparison with other methods is made. (auth)

12935 MINIMIZING THE MAXIMUM DEVIATION FOR CORRELATED MONTE CARLO CALCULATIONS. Steinberg, H. A. (MAGI, Elmsford, NY). Trans. Am. Nucl. Soc.; 21: 551-552(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

12936 DEFINITION OF TIME OPERATOR IN QUANTUM MECHANICS. Nowicki, A. A. (Univ., Wroclaw). Bull. Acad. Pol. Sci., Ser. Sci. Math. Astron. Phys.; 22: No. 10, 1069-1075 (1974).

Different approaches to the quantum-mechanical definition of time operator $\hat{T}$ are briefly discussed. In particular the analytic continuation of the time operator is defined, and it is shown that one can construct its exact eigenstates. Also the case of a relativistic free scalar particle is considered and the notion of proper time operator $\hat{S}$ is discussed. (auth)

12937 ISOMORPHISM OF A QUANTUM LOGIC WITH THE LOGIC OF THE PROJECTIONS IN A HILBERT SPACE. Cirelli, R.; Cotta–Ramusino, P.; Novati, E. (Univ., Milan). Int. J. Theor. Phys.; 11: No. 2, 135-144(Oct 1974).

The results about the isomorphism of a quantum logic L with the logic of the projections in a separable Hilbert space previously obtained with the introduction of the topology of states are completed, including the case of nonseparable Hilbert space, and showing that the continuity of the anti-automorphism θ of the division ring R, C or Q determined by L follows from the general topological assumptions on L. (auth)

12938 MOTION OF A PARTICLE WITH ANISOTROPIC MASS. Cheon, I. T. (Univ., Liege). Int. J. Theor. Phys.; 11: No. 2, 125-133(Oct 1974).

On the basis of the hypothesis that particle mass is ansiotropic rather than isotropic, the relativistic motion of a particle within the framework of flat space-time is investigated. Assuming that the mass anisotropy is associated with the photon cloud of the particle, it is argued that the self-energy of a particle is of the order of magnitude $|\delta m/M_0| \sim 0.0005$, for which conventional quantum electrodynamics, however, gives an infinite value. (auth)

12939 ENTROPIC UNCERTAINTY RELATION. Mamojka, B. (Slovenska Akademia Vied, Bratislava). Int. J. Theor. Phys.; 11: No. 2, 73-91(Oct 1974).

Shannon's entropy is used for the formulation of the uncertainty relation. Two concrete examples are solved: the case of dynamically commuting continuous observables, and the case of the h/2 spin projections. (auth)

12940 PROBLEM OF UNIQUENESS REGARDING H-FUNCTION CALCULATIONS. Siewert, C. E. (Univ., Lillie, Villeneuve–d'Ascq, France). J. Quant. Spectrosc. Radiat. Transfer.; 15: No. 5, 385-387(May 1975).

It is shown that the developed L equation, especially useful for H-function calculations when ω is close to unity, has a unique solution. (auth)

12941 GLOBAL EXISTENCE OF SOLUTIONS TO THE CAUCHY PROBLEM FOR TIME-DEPENDENT HARTREE EQUATIONS. Chadam, J. M.; Glassey, R. T. (Indiana Univ., Bloomington). J. Math. Phys. (N.Y.); 16: No. 5, 1122-1130(May 1975).

The existence of global solutions to the Cauchy problem for time-dependent Hartree equations for N electrons is established. The solution is shown to have a uniformly bounded $H^1(R^3)$ norm and to satisfy an estimate of the form two parallel PSI (t) two parallel /sub H^2; less than or equal to c exp(kt). It is shown that "negative energy" solutions do not converge uniformly to zero as t yields infinity. (auth)

12942 QUANTUM-MECHANICALLY SOLVABLE NON-POLYNOMIAL LAGRANGIAN WITH VELOCITY-DEPENDENT INTERACTION. Mathews, P. M.; Lakshmanan, M. (Univ. of Madras). Nuovo Cim.; 26A: No. 3, 299-316(1 Apr 1975).

The quantum-mechanical problem of the nonlinear oscillator with the Lagrangian $L = \frac{1}{2}\,[(\dot{x}^2 - k_0x^2)/(1 - \lambda x^2)]$ is solved exactly and the energy levels and eigenfunctions are obtained completely. This model (when $k_0 = 0$) is the zero-space-dimensional isoscalar analog of the nonlinear $SU_2 \otimes SU_2$ chirally invariant Lagrangian in the Gasiorowicz–Geffen coordinates and may also be considered as a modified version of the anharmonic-oscillator and Lee-Zumino models. The bound-state energy levels are found to have a linear dependence on the coupling parameter, in sharp contrast to the case of the familiar oscillator with quartic anharmonicity where the energy as a function of λ, has complicated singularities at $\lambda = 0$. It is investigated how far certain standard approximation procedures reproduce the exact results. The Bohr-Sommerfeld quantization procedure is found to reproduce the form of the bound-state energy levels correctly. Interestingly a perturbation-theoretic treatment also reproduces the correct results at least up to the order (λ^2) to which one carried the calculations. (auth)

12943 CONDITIONAL PROBABILITY AMPLITUDES IN WAVE MECHANICS. Hunter, G. (Univ. of Florida, Gainesville). Int. J. Quant. Chem.; 9: No. 2, 237-242(Mar 1975).

The total wave function of a system psi (x,y) is expressed as a product of a marginal amplitude function f(y) and a conditional amplitude function phi (x/parallel/y). The original Schroedinger equation H psi equals E psi is reduced to a Schroedinger equation for the marginal amplitude H'f equals Ef. The factorization of psi is in principle exact. It achieves a partial separation of the variables x and y. (auth)

Quantum Field Theories

Refer also to abstracts 12530, 12618, 12654, 12655, 12658, 12695, 12984, and 13003.

12944 (IS-T-681) FIELD THEORY ANOMALIES INVOLVING THE ENERGY-MOMENTUM TENSOR. Zacrep, D. B. (Ames Lab., Iowa (USA)). May 1975. Contract W-7405-eng-82. 94p. Dep. NTIS $7.75.

Thesis.

Generalized Ward-Takahashi identities (WTI's) of the energy—momentum tensor in a free spinor field thoery with SU(3) currents were analyzed for possible noncanonical behavior (anomalies). The WTI's, derived by a functional integration technique, are the divergence equations for the axial-vector, vector, and tensor currents in n-point functions (n-pf's), i.e., Green's functions, involving the energy-momentum tensor and all possible combinations of vector, axial-vector, scalar, and pseudo-scalar external currents (V, A, S, and P). In addition the trace identities (TI) of the n-pf's involving the energy-momentum tensor were investigated. The WTI's and trace identities were first checked by naive manipulation of single loop Feynman diagrams, (i.e., ignoring divergences and surface terms in shifts of integration variables). Then defining "physical" amplitudes in terms of a Pauli-Villars type regularization and a self-consistent renormalization scheme (by addition of polynomial counterterms), possible anomalies of the WTI's and TI were defined. As a result of the regularization, 1/m-terms of n-pf's having a coefficient m in the axial-vector WTI and the trace identity were found to contribute to possible anomalies. Using the counterterms in a self-consistent manner, it was found that all the tensor and vector WTI's could be satisfied (thus satisfying Poincare and gauge invariance, respectively), while anomalies were found in the axial-vector WTI and trace identity. The AWTI anomalies found were shown to be consistent with axial-vector anomalies found previously in n-pf's without the energy-momentum tensor, namely in abnormal parity n-pf's with up to five V and A currents but no S or P currents. The TI anomalies were found in a variety of normal parity n-pf's up to n equals 5. The TI anomalies are consistent with anomalies found previously at zero momentum. Supplementary material on the relation of S-matrix and mass matrix formalism for doubled resonances is also presented. Implications and possible phenomenological applications are discussed. (auth)

12945 (ITP-74-132E) TOPOLOGY IN THE SPACE ϕF AND CLUSTER PROPERTY OF WIGHTMAN FUNCTIONS. Lomsadze, Yu. M.; Krivsky, I. Yu.; Shuba, Yo. M. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1974. 25p. Dep. NTIS (US Sales Only) $4.25.

A topology is introduced in the space ϕ_F of test functions for the concentratable (i.e., WR- or OR-) Wightman field $\phi(f)$, and the field $\phi(f)$ is shown to be weakly continuous in the topology introduced. It is proved that both in the Wightman ϕ_F^F and ϕ_F^F axiomatic approaches the unitary representation of the proper Poincaré group in the physical Hilbert space is continuous and weakly infinitely differentiable. Finally, the Wightman functions

for the concentratable field are proved to possess the cluster property. (auth)

12946 (JINR-E2-8688) REPRESENTATION OF SUPERCONFORMAL ALGEBRA. Two- and Three-Point Green Functions of Scalar Superfields. Molotkov, V. V.; Petrova, S. G.; Stoyanov, D. T. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 21p. Dep. NTIS (US Sales Only) $4.25.

Some set of representations of the superconformal algebra is considered. The finite superconformal transformations for scalar superfields are obtained. Two and three point Green's functions are constructed. Restrictions on the anomalous dimensions of the superfields are obtained so the three point functions do not vanish. (auth)

12947 (NBI-HE-74-19) LATTICE GAUGE THEORIES AND MOTION IN GROUP SPACE. Canning, G. P.; Foerster, D. (Niels Bohr Institutet, Copenhagen (Denmark); Technische Univ. Clausthal, Clausthal-Zellerfeld (F. R. Germany). Inst. fuer Theoretische Physik). Dec 1974. 18p. Dep. NTIS $4.00.

The SU(2) lattice gauge theory of Kogut and Susskind is extended to a general nonabelian gauge group. At the Lagrangian level, the theory is found to be related to the motion of a point in group space. Such a system is quantized using the natural geometric structure of group parameter space, and the results applied to find the Hamiltonian for the general lattice gauge theory. The large N behavior of the theory is also discussed. (auth)

12948 (NBI-HE-75-3) INFRARED DECOUPLING OF MASSIVE FIELDS AND THE RENORMALIZATION GROUP. Olesen, P. (Niels Bohr Institutet, Copenhagen (Denmark)). Apr 1975. 37p. Dep. NTIS (US Sales Only) $5.00.

The decoupling of massive fermions in the infrared limit is proposed as a boundary condition on the renormalization group equations in the formulations of Gell-Mann and Low and of Weinberg. The assumption is made that if one has a finite infrared stable fix point in one formalism, then this remains true in the other formalism. Some constraints are derived for asymptotically free theories. It is shown that if the pure Yang-Mills theory has a finite infrared stable fix point, then this (fermion-independent) coupling must also be the fix point in a theory with massless fermions. Since the theory with massless fermions still "remembers" that it ceases to be asymptotically free with sufficiently many fermions, it is argued that the Yang-Mills fix point is unlikely to be a fix point of the massless theory, or that the β function is likely to have a singularity. (auth)

12949 (ORO-3992-205) NOTE ON QUANTIZATION OF WEINBERG UNIFIED FIELD THEORY. Deshpande, N. G.; Kielanowski, P. (Texas Univ., Austin (USA). Center for Particle Theory). 1974. 9p. (CPT-249). Dep. NTIS $4.00.

Equivalence of the Lagrangian formulation of Hsu and Sudarshan to the conventional Fujikawa, Lee and Sanda formulation of the Weinberg model is demonstrated. (auth)

12950 (ORO-3992-219) GOLDSTONE REALIZATION OF gamma$_5$-GAUGE SYMMETRY IN QUANTUM ELECTRODYNAMICS. Narayanaswamy, N. (Texas Univ., Austin (USA). Center for Particle Theory). 1974. 25p. Dep. NTIS $4.25.

The relevance of the Goldstone theorem to quantum electrodynamics with zero bare mass electrons is reexamined. It is shown that solutions exist corresponding to the Goldstone realization of gamma$_5$-gauge symmetry. The result will also be valid for fermion quarks interacting strongly with massless vector gluons. (auth)

12951 IDEAS ABOUT THE ROLE OF CURRENTS IN PARTICLE PHYSICS. Dashen, R. (Institute for Advanced Study, Princeton, N. J. (USA)). pp 1-15 of Local Currents and Their Applications. Sharp, D. H.; Wightman, A. S. (eds.). Amsterdam; North-Holland Publishing Company (1974).

From conference on local currents and their applications; Princeton, New Jersey, USA (8 Oct 1971).

The present understanding of the relevance of currents to particle physics is reviewed. Questions which may be faced in the future are discussed: has the hadron light cone really been reached in the inelastic electron-scattering experiments at SLAC and what happens if the quark model successfully predicts the results of deep-inelastic neutrino scattering but nobody finds the quark? Hadron symmetries, light cone commutators and the problem of asymptopia are discussed. (PJS)

12952 WHAT CONSTRUCTIVE FIELD THEORY SAYS ABOUT CURRENTS. Jaffe, A.; McBryan, O. (Harvard Univ., Cambridge, Mass. (USA). Lyman Lab. of Physics). pp 17-30 of Local Currents and Their Applications. Sharp, D. H.; Wightman, A. S. (eds.). Amsterdam; North-Holland Publishing Company (1974).

From conference on local currents and their applications; Princeton, New Jersey, USA (8 Oct 1971).

Currents are studied in the framework of two-dimensional model field theories. Three types of divergences are encountered: the infinite volume divergence, ultraviolet divergences and divergence of perturbation expansions. The problems of renormalization can be overcome and the renormalized currents are operators or bilinear forms on domains of physical states. A non-trivial current algebra exists in the Y_2 theory, and the product of two fields on the light cone is the $P(\phi)_2$ theory with a volume cutoff is studied. (PJS)

12953 CURRENT COMMUTATORS ON THE LIGHT CONE. Brandt, R. A. (New York Univ., N. Y. (USA). Dept. of Physics). pp 31-84 of Local Currents and Their Applications. Sharp, D. H.; Wightman, A. S. (eds.). Amsterdam; North-Holland Publishing Company (1974).

From conference on local currents and their applications; Princeton, New Jersey, USA (8 Oct 1971). 110 refs.

One of the earliest encounters of the light cone (LC) in particle physics was the observation that the infinite-momentum techniques of current algebra lead to statements about the LC commutator of the currents. In order to describe this development, the forward spin-averaged connected covariant retarded current-proton scattering amplitude is considered. Only the SU(3) vector current $J^a_\mu(x)$ is explicitly considered, although all the equations can be immediately generalized to include the axial-vector currents. (auth)

12954 WHAT WE HAVE LEARNED ABOUT REPRESENTING LOCAL NONRELATIVISTIC CURRENT ALGEBRAS. Sharp, D. H. (Pennsylvania Univ., Philadelphia (USA). Dept. of Physics). pp 85-98 of Local Currents and Their Applications. Sharp, D. H.; Wightman, A. S. (eds.). Amsterdam; North-Holland Publishing Company (1974).

From conference on local currents and their applications; Princeton, New Jersey, USA (8 Oct 1971).

To write a field theory in terms of local currents, several theories were taken and a number of "currents" defined by taking bilinear products of the fields at the same space-time point. An equal-time current algebra was obtained for the set of currents using the definition of the currents in terms of fields and the canonical commutation relations. A closed equal-time algebra of currents was thus obtained, and the Hamiltonian written in terms of these currents. The models obtained in this way are discussed. (PJS)

12955 WHAT WE HAVE LEARNED ABOUT LOCAL RELATIVISTIC CURRENT ALGEBRAS. Goldin, G. A. (Pennsylvania Univ., Philadelphia (USA). Dept of Physics). pp 99-114 of Local Currents and Their Applications. Sharp, D. H.; Wightman, A. S. (eds.). Amsterdam; North-Holland Publishing Company (1974).

From conference on local currents and their applications; Princeton, New Jersey, USA (8 Oct 1971).

Relativistic models written in terms of local currents are examined. The following models are discussed: models with c-number Schwinger terms, without internal symmetry; the Sugawara model; models with operator Schwinger terms; models combining operator Schwinger terms and internal symmetry; the quark model and ultra-local models. (PJS)

12956 MATRIX ELEMENTS OF LOCAL OPERATORS. Anderson, B. (Princeton Univ., N. J. (USA). Joseph Henry Labs.). pp 115-130 of Local Currents and Their Applications. Sharp, D. H.; Wightman, A. S. (eds.). Amsterdam; North-Holland Publishing Company (1974).

From conference on local currents and their applications; Princeton, New Jersey, USA (8 Oct 1971).

Recent results concerning the analytic structure of some matrix elements of products of two local operators are reported. In particular the properties of the momentum-space quantity corresponding to a matrix element of the kind $\langle 0|A(x_1)B(X_2)|p_3E_3\rangle$ are discussed, where the symbol $\langle 0|$ stands for the vacuum state and $|P_3,E_3\rangle$ a state with sharp energy-momentum vector $p_3 = (P_3,E_3)$ created from the vacuum by a field operator C, which is local with respect to the fields A and B. In order to minimize the notational complications the operators A, B and C are taken to be scalar operators. The problems discussed are the following: (i) Can relations be found between the form factors $\langle P_1|B|P_2\rangle$ and $\langle P_1|A|P_3\rangle$? (The states $|P_1\rangle$ and $|P_2\rangle$ have prescribed energy-momentum vectors P_1 and P_2 and are related to the fields A and B, respectively; in the same way the state $|P_3\rangle$ above is to the field C.) (ii) Can the above matrix element be described by means of the independent parameters of the form factors? (auth)

12957 A THEORY OF ELECTROMAGNETIC AND WEAK INTERACTIONS. Lee, B. W. (National Accelerator Lab., Batavia, Ill. (USA)). pp 131-141 of Local Currents and Their Applications. Sharp, D. H.; Wightman, A. S. (eds.). Amsterdam; North-Holland Publishing Company (1974).

From conference on local currents and their applications; Princeton, New Jersey, USA (8 Oct 1971).

The theories of unifying electromagnetic and weak interactions, and constructing a renormalizable theory of weak interactions are described. The renormalizability of the Weinberg model is discussed. The scheme can be extended to include hadrons provided the theory is renormalizable, accommodates a non-vanishing Cabibbo angle, contains no massless particles except the photon and does not give any strangeness-changing neutral current in first order. A scheme which satisfies these conditions is the model of Glashow, Iliopoulos and Maiani, in which a fourth quark is postulated. (PJS)

12958 ANOMALIES IN WARD IDENTITIES AND CURRENT COMMUTATION RELATIONS. Adler, S. L. (Institute for Advanced Study, Princeton, N. J. (USA)). pp 143-168 of Local Currents and Their Applications. Sharp, D. H.; Wightman, A. S. (eds.). Amsterdam; North-Holland Publishing Company (1974).

From conference on local currents and their applications; Princeton, New Jersey, USA (8 Oct 1971).

Examples of anomalous Ward identities are given, with ways of seeing why the anomaly is there. The absence of radiative corrections to the anomalous axial-vector divergence equation is discussed. Consequences of the anomalies in quantum electrodynamics and PCAC models are given, and anomalous commutators and anomalous scaling are also discussed. (PJS)

12959 SUPERSYMMETRY AND THE VACUUM. Zumino, B. (European Organization for Nuclear Research, Geneva (Switzerland)). Nucl. Phys., B; 89: No. 3, 535-546(28 Apr 1975).

It is shown that, in a supersymmetric theory, the sum of all vacuum diagrams vanishes identically as a consequence of compensations among contributions involving different fields of the supermultiplet. This means that the zero-point energy-momentum density is zero to all orders in the supersymmetric interaction. In an external gravitational field no cosmological term is induced through the vacuum polarization of the matter fields. The situation when supersymmetry is spontaneously broken, or softly broken is also discussed. (auth)

12960 HEAVY ELEMENTARY FERMIONS AND PROTON STABILITY IN UNIFIED THEORIES. Fritzsch, H.; Minkowski, P. (California Inst. of Tech., Pasadena (USA)). Phys. Lett., B; 56: No. 1, 69-72(31 Mar 1975).

The construction of renormalizable unified theories of the strong, electromagnetic and weak interactions requires the existence of thus far unobserved elementary fermions. Their properties are abstracted from a large class of unified theories. It is pointed out that fermion doubling is a general feature of unified theories. (auth)

12961 FIELD THEORY AS NOISE THEORY. Klauder, J. R. (Bell Telephone Labs., Inc., Murray Hill, N. J. (USA)). Phys. Lett., B; 56: No. 1, 93-95(31 Mar 1975).

The formulation of certain generalized stationary ergodic stochastic processes is shown to exhibit divergences entirely analogous to those encountered in covariant quantum field theory in n space-time dimensions, $n \geq 2$. Consequently, clues to unanswered questions in field theory may possibly be found in noise theory. (auth)

12962 SUPERGAUGE INVARIANT EXTENSION OF THE HIGGS MECHANISM AND A MODEL FOR THE ELECTRON AND ITS NEUTRINO. Fayet, P. (Ecole Normale Superieure, 75 - Paris (France)). Nucl. Phys., B; 90: No. 1, 104-124(5 May 1975).

The Higgs mechanism is extended in a supergauge invariant way. Spontaneous symmetry breaking occurs for all allowed values of the parameters of the scalar potential. With $SU(2) \times U(1)$ as gauge group and after spontaneous breaking of supergauge invariance, a model of weak and electromagnetic interactions is obtained for the electron and its neutrino, which includes also heavy leptons and scalar particles. The neutrino is the Goldstone fermion, associated with the photon in a massless vector multiplet. (auth)

12963 THE EFFECTIVE POTENTIAL FOR THE YANG-MILLS FIELD. Drummond, I. T.; Fidler, R. W. (Cambridge Univ. (UK). Dept. of Applied Mathematics and Theoretical Physics). Nucl. Phys., B; 90: No. 1, 77-103(5 May 1975).

The effective potential is calculated for the Yang-Mills field in the one-loop approximation. Improvements of the one-loop contribution brought about by the renormalization group are discussed. Because of the asymptotic freedom of the theory it is only possible to use perturbation theory for sufficiently large values of the vacuum field. The manner in which the effective action might give rise to a self-sustaining vacuum field and quark containment is discussed. (auth)

12964 ANOMALOUS DIMENSIONS IN BACKGROUND FIELD GAUGES. Sarkar, S.; Strubbe, H. (European Organization for Nuclear Research, Geneva (Switzerland)). Nucl. Phys., B; 90: No. 1, 45-51(5 May 1975).

Background field gauges, recently proposed for calculation of anomalous dimensions of operators in Wilson expansions in non-Abelian gauge theories, require the evaluation of extra diagrams. These diagrams are calculated and are found to give a correct gauge-invariant-mixing (unlike in Fermi-type gauges), but nevertheless the anomalous dimensions of the operators, owing to interesting cancellations, remain unchanged from those found in the Fermi gauges. (auth)

12965 EIGHTH-ORDER CONTRIBUTION TO THE CALLAN-SYMANZIK FUNCTION IN QUANTUM ELECTRODYNAMICS FROM FOURTH-ORDER VACUUM POLARIZATION INSERTIONS. Calmet, J. (European Organization for Nuclear Research, Geneva (Switzerland)); Rafael, E. de (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). Phys. Lett., B; 56: No. 2, 181-184(14 Apr 1975).

The contribution to the Callan-Symanzik function $\beta(\alpha)$ in quantum electrodynamics has been calculated from the Feynman diagrams corresponding to fourth-order vacuum polarization corrections to the fourth-order vacuum polarization. The result is $(\alpha/\pi)^4\{-61/1296 + (2/27)\pi^2 + (1/2)\xi(3)\} = 1.285\ (\alpha/\pi)^4$. (auth)

12966 GENERALIZED SUPER-GAUGE SYMMETRY AS A NEW FRAMEWORK FOR UNIFIED GAUGE THEORIES. Nath, P.; Arnowitt, R. (Northeastern Univ., Boston, Mass. (USA). Dept. of Physics). Phys. Lett., B; 56: No. 2, 177-180(14 Apr 1975).

Supersymmetry is generalized to a local gauge invariance. The gauge group unifies electromagnetic (or Yang-Mills) gauge with space-time coordinate invariances. All fields arise from a single gauge superfield. The non-abelian invariance produces self-interactions in the field equations. These automatically generate coupled Maxwell-Dirac, Einstein equations, etc. (auth)

12967 HILBERT SPACE APPROACH TO THE QUANTUM MECHANICAL THREE-BODY PROBLEM. Ginibre, J.; Moulin, M. (Paris- 11 Univ., 91- Orsay (France). Lab. de Physique Theorique et Hautes Energies). Ann. Inst. Henri Poincare, Sect. A; 21: No. 2, 97-145(1974).

The quantum mechanical three-body problem is studied in n-dimensional space ($b \geq 3$) with pair potentials that decrease at infinity as $x^{2\epsilon}$. Hilbert space methods are used exclusively in configuration space (in particular, Kato's theory of smooth operators and Agmon's a priori estimates in weighted Hilbert spaces). Most of Fadeev's results are covered. In particular, the negative spectrum of H is proved to consist, besides the expected absolutely continuous part, of isolated eigenvalues of finite multiplicities which can accumulate at most at zero and at the two-body thresholds from below. The positive singular spectrum is contained in a closed set of measure zero, and the wave operators are asymptotically complete. (FR)

12968 RENORMALIZATION OF NON-ABELIAN LOCAL GAUGE THEORIES. Costa, G.; Tonin, M. (Univ., Padua). Riv. Nuovo Cim.; 5: No. 1, 29-107(1975).

The discussion of non-Abelian local gauge theories includes the theory of classical Yang–Mills fields, quantization of Yang–Mills theories, generalized Ward identities, renormalization of Yang–Mills theories, and gauge independence and unitary of the S-matrix. (JFP)

12969 COMPUTATIONAL PHYSICS. Potter, D. London; John Wiley and Sons (1973). 315p.

The subject is dealt with as follows: the nature of computational physics; elements of the difference method; partial difference equations for continuous media; numerical matrix algebra; particles—N-body action at a distance; particle-field calculations; particles in self-consistent fields—atoms and solids; phase fluids; classical fluid dynamics; hydrodynamics with long-range forces—stars, plasmas, magneto-fluids. (UK)

12970 POINCARE GENERATORS FOR THE FREE SPIN $^3/_2$ FIELD. Mainland, G. B. (Dublin Inst. for Advanced Studies). Proc. R. Irish Acad.; 74A: No. 12, 87-90(1974).

The action principle is employed to identify the generators of infinitesimal Poincaré transformations and the positive definite anticommutator of the spin-$^3/_2$ field is then used to verify explicitly that the quantities do in fact satisfy the Lie algebra of the Poincaré group. The calculational techniques may be useful in studying interacting spin-$^3/_2$ theories where serious problems arise. (auth)

12971 CONFORMAL PROPERTIES OF A POINCARE INVARIANT FIELD THEORY. Browne, S. (University Coll., Dublin). Proc. R. Irish Acad.; 74A: No. 7, 48-59(1974).

A technique is presented for examining the conformal properties of any quantity of interest in a Poincaré invariant field theory, and certain applications of the method are described. In particular,

it is proved that in a conformally invariant theory the Bellinfante tensor possesses a covariant transformation law under special conformal transformations and in a "nearly" conformally invariant theory the correct procedure is to change to a new equivalent second order Lagrangian which is conformally invariant. Although the Bellinfante tensor for this new Lagrangian does not have a covariant transformation law under special conformal transformations the "new improved" energy momentum tensor has. (auth)

12972 RENORMALIZATION GROUP IN A NONRENORMALIZABLE FIELD THEORY. Blokhintsev, D. I.; Efremov, A. V.; Shirkov, D. V. (Joint Inst. for Nuclear Research, Dubna, USSR). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 12, 23-29(1974). (In Russian).

Functional equations of a renormalization group are formulated for theories having dimensional binding constants. The structure of the general solutions of the equations is established for an invariant charge. Particular attention is devoted to models having a negative mass dimensionality of the binding constants (that is, to models that are not renormalizable in ordinary perturbation theory). The correspondence of the general solutions in the ultraviolet region with ordinary perturbation theory leads to a nonanalytical quality in the binding constant. An additional assumption on the finiteness of the invariant charge number leads to limitations on the parameters of the R-operations of Bogolyubov. A discussion is presented on the possibility of large scale invariance at small distances. As an illustration of these hypotheses a look is taken at an exactly-solvable, nonrenormalizable, nonrelativistic model. (SJR)

12973 THEORETICAL ELECTRODYNAMIC STUDIES OF ELECTRONS INTERACTING WITH THE QUANTIZED FIELD OF A PLANE WAVE. I. Bagrov, V. G.; Gitman, D. M.; Kuchin, V. A.; Lavrov, P. M. (Tomsk State Univ., USSR). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 12, 89-94(1974). (In Russian).

This is the first part of a study attempting to explain a number of unsolved, theoretical problems of a well known model, that of an electron and a secondarily quantized plane wave. Approximations are found that should be made in order to approach this model from an exact, quantum electrodynamics. A number of mathematical and physical features of the problem were investigated. (SJR)

12974 FIVE- AND EIGHT-VECTOR EXTENSIONS OF RELATIVISTIC QUANTUM THEORY: THE PREFERRED REFERENCE FRAME. Edmonds, J. D. Jr. (San Diego State Coll., CA). Int. J. Theor. Phys.; 10: No. 4, 273-290(Aug 1974).

The complex quaternion approach to relativistic quantum theory is extended to include time, in the preferred cosmic reference frame, as a fifth dimension. Particle mass appears as an eigenvalue of this invariant operator. Closing the extended algebra also suggests three additional space-time components, possibly related to microscopic rotational degrees of freedom and the scale setting fundamental length. The Dirac, Klein–Gordon, Maxwell, and Einstein equations are generalized to accommodate 5- and 8-vector space-time, including gravitational curvature. The usual conserved probability density is shown to harbor fundamental difficulties. (auth)

12975 FURTHER STUDIES IN AESTHETIC FIELD THEORY V; HIGHER DIMENSIONS. Muraskin, M.; Ring, B. (North Dakota Univ., Grand Forks). Int. J. Theor. Phys.; 11: No. 2, 93-105(Oct 1974).

Higher dimensional universes in which the universe is constructed from four-dimensional subuniverses are considered. Independent parameters are introduced for the subuniverses. A small coupling between the subuniverses is then considered. Emphasis is placed on the eight-dimensional case. It is found that the trends from the computer are in line with the natural boundary conditions $\Gamma^i_{jk} \to 0$ being satisfied. No significant improvement resulting as a consequence of the higher dimensions over and beyond previous four-dimensional work is found. (auth)

12976 CATTANEO DERIVATIVE AND THE SPECIAL LAGRANGIAN DERIVATIVE. Grioli, A. Atti Accad. Naz. Lincei, Rend., Cl. Sci. Fis., Mat. Nat.; 55: No. 5, 450-455(Nov 1973). (In Italian).

Cattaneo's relative formulation of relativistic mechanics is based on the covariant transverse derivative of an arbitrary totally spatial tensor field. On the other hand, Bressan bases relativistic elasticity, possibly with couple stresses, on the Lagrangian spatial derivative of an arbitrary double tensor. A chronotopic expression of the spatial projection of the Lagrangian derivative is given in the case that the reference configuration coincides with the one of the body on a locally time-orthogonal space-time section in S. By the chronotopic expression above, the relation is determined between the two derivatives and the coincidence of the nine significative components is proven. Furthermore a short proof is given of a fundamental theorem of Cattaneo on the transverse derivative. (auth)

12977 S-MATRIX IN CONSTRUCTIVE QUANTUM FIELD THEORY. Ivanov, S. S.; Petrina, D. Ya.; Rebenko, A. L. (Inst. of Theoretical Physics, Moscow). Teor. Mat. Fiz.; 23: No. 2, 160-177(May 1975). (In Russian).

A new approach to investigation of the equations for coefficient functions of scattering matrix in infinite volume is developed on the example of self-interacting boson field in two-dimensional space-time. The solution of some approximated equations is obtained in the Hilbert space of translationally invariant functions, directly for the infinite volume. (auth)

12978 FOURIER TRANSFORMATION OF A CERTAIN CLASS OF HYPERFUNCTIONS AND FORMULATION OF LOCAL COMMUTATIVITY CONDITION IN THE FRAMEWORK OF LOCALIZABLE QUANTUM FIELD THEORY IN TERMS OF THE HYPERFUNCTIONS. Romanko, G. D.; Khimich, I. V. (Uzhgorod State Univ., USSR). Teor. Mat. Fiz.; 23: No. 2, 199-213(May 1975). (In Russian).

Theory of hyperfunctions is used for the formulation of aximatic local quantum field theory. Class L of hyperfunctions is introduced, which are local in coordinate as well as in the momentum space. Direct and inverse Fourier transformation of the hyperfunctions of the class L is defined and the relation of these hyperfunctions to generalized functions from the space S'_1 is established. On the basis of the notion of the support of the hyperfunction the locality axiom is formulated for localizable field theories. (auth)

12979 LATTICE APPROXIMATION OF THE (LAMBDA PHI^4–MUPHI)$_2$ FIELD THEORY IN A FINITE VOLUME. Park, Y. M. (Watson Research Center, Yorktown Heights, NY). J. Math. Phys. (N.Y.,); 16: No. 5, 1065-1075(May 1975).

For space-time regions with finite volumes, the lattice cutoff unnormalized Schwinger functions converge to the (unnormalized) Schwinger functions as the lattice cutoff is removed. (auth)

12980 MASSLESS HANDED FIELD OF SPIN ONE. Umezawa, M. (Centre de Recherches Nucleaires, Strasbourg). Nuovo Cim.; 26A: No. 2, 182-194(21 Mar 1975).

The handed interaction between a massless spin–one-half particle and the massless spin-one field is introduced. One constructs explicitly the potential for the handed field of spin one which can be used in the perturbation calculation, that is the free potential. This is done by constructing the transverse part of the potential and then extending it into the relativistic form. One also derives the d'Alembertian equation for the interacting handed potential. (auth)

12981 STRINGS AND FIELDS. Venturi, G. (Univ., Bologna). Nuovo Cim.; 26A: No. 2, 97-104(21 Mar 1975).

A system consisting of a scalar field localized on a string is examined. It is suggested how such a system could arise and exhibit the equations of motion and boundary conditions obtained on treating the string coordinates and the field as independent dynamical variables. In the case of a static solution for the field it is shown that the classical system can give rise to a linearly rising trajectory with a physical (negative) intercept. (auth)

12982 PROPERTIES OF PARTIAL-WAVE AMPLITUDES IN CONFORMAL INVARIANT FIELD THEORIES. Ferrara, S. (CERN, Geneva); Gatto, R.; Grillo, A. F. Nuovo Cim.; 26A: No. 3, 226-236(1 Apr 1975).

Analyticity properties of partial-wave amplitudes of the conformal group $O_{D,2}$ (D not necessarily integer) in configuration space are investigated. The presence of Euclidean singularities in the Wilson expansion in conformal invariant field theories is discussed, especially in connection with the program of formulating dynamical bootstrap conditions coming from the requirement of causality. The exceptional case of D = 2 is discussed in detail. (auth)

12983 NEW GEOMETRICAL APPROACH TO NONSYMMETRIC UNIFIED FIELD THEORY. Ghosh, N. N. (Indian Association for the Cultivation of Science, Calcutta). Indian J. Pure Appl. Math.; 4: No. 11-12, 856-861(1973).

The geometry of a pair of "mutually exclusive" four dimension sional varieties V_1 and V_2 embedded in a Minkowskian n-space is studied by tensor methods. The two sets of tangent vectors $C_\mu D_\nu$ at corresponding points of V_1 and V_2 define by their scalar products a nonsymmetric $g_{\mu\nu}$ whose symmetric part $g_{\mu\nu}$ represents gravitational metric tensor $S_{\mu\nu}$ and the anti-symmetric part the electromagnetic tensor $F_{\mu\nu}$. But the connections are symmetric in μ,ν. Starting from "modified" sets of tangent vectors and applying tensor methods a geometry of unified field theory was developed in which the connections are nonsymmetric satisfying Einstein's equation but $S_{\mu\nu}$ and $F_{\mu\nu}$ are connected with the fundamental nonsymmetric tensor of the field in a more complicated way. (auth)

Gravitation and General Relativity

Refer also to abstract 12454.

12984 VACUUM FLUCTUATIONS OF A QUANTIZED SCALAR FIELD IN A ROBERTSON–WALKER UNIVERSE. Streeruwitz, E. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik). Phys. Lett., B; 56: No. 1, 66-68(31 Mar 1975).

Modifications of the field equations of general relativity due to the presence of matter fields have been studied in recent years. It has been shown by general considerations that the vacuum expectation value of the energy momentum tensor of a quantized scalar field corresponds to divergent cosmological, Einstein- and quadratic terms (R^2,$R_{\mu\nu}R^{\mu\nu}$) renormalizing the classical Einstein Lagrangian. The influence of the vacuum fluctuations of a quantized scalar field on the effective gravitation Lagrangian is calculated for a nonstatic Robertson–Walker universe. (auth)

12985 A STUDY OF INCOHERENT NULL FLUID USING THE NEWMAN–PENROSE SPIN COEFFICIENTS FORMALISM. Leaute, B. (Paris- 6 Univ., 75 (France). Inst. Henri Poincare). Compt. Rend., Ser. A, B; 280: No. 2, 49-51(13 Jan 1975). (In French).

The expression for the total energy-momentum emitted in a transition between two stationary states confirms the validity of the Bondi–Sachs energy-momentum formula for the outgoing gravitational radiation. (auth)

12986 INTERACTION OF GRAVITONS AND PHOTONS. Skobelev, V. V. Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 1, 76-80(1975). (In Russian).

Calculations are made of the amplitudes of photon-graviton scattering and the crossing process which is the annihilation of two photons to two gravitons and the reverse. It is shown that these processes are gradient invariant. It was also found that on scattering at any angle the spirality of the photons and gravitons does not change, and annihilation is possible only at the same spiralities of photons (gravitons). An analysis is made of the differential cross sections as a function of scattering angles. (SJR)

12987 LIMITING TRANSITIONS IN TOLMEN'S SOLUTIONS OF THE EQUATIONS OF THE GENERAL THEORY OF RELATIVITY. Korkina, M. P.; Chernyi, L. M. (Dnepropetrovsk State Univ., USSR). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 1, 23-26(1975). (In Russian).

Limiting transitions to the special theory of relativity and to Newton's gravitational theory are considered in Tolmen's solutions of Einstein's equations. It is shown that elliptical systems do not have an analog in the special theory of relativity. For hyperbolic and parabolic systems the analogs are the noninertial systems of Robertson and the inertial systems of special relativity theory respectively. It is shown that the transition to Newton's gravitational theory can be accomplished for Tolmen's coordinate systems of any type. (SJR)

12988 BEHAVIOR OF A TEST BODY IN A PLANE GRAVITATIONAL WAVE. Borovko, E. V. Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 1, 112-115(1975). (In Russian).

The motion of a test particle in a plane gravitational wave is considered with the system of measuring: $ds^2 = e^{\nu}c^2dt^2 - e^{\nu}dx^2 - dy^2 - dz^2$. It is shown that in the case of velocities less than the velocity of light, during a change of ν and λ according to a harmonic rule the test particle will undergo harmonic oscillations along the x, y, and z axes. (SJR)

12989 CENTRAL SYMMETRICAL STATIC VACUUM FIELD IN THE TETRAD THEORY OF GRAVITATION. Tunyak, V. N. (Belorussian State Univ., Minsk). Vestsi Akad. Navuk BSSR, Ser. Fiz.-Mat. Navuk; No. 1, 66-70(1975). (In Russian).

The point of central-symmetrical static vacuum operation in the tetrad theory of gravitation was obtained. The corresponding dispersion of gravitational energy was determined, and it was shown that the known conditions of correspondence with Newtonian determination of gravistatic energy and correct determination of integral energy pulses of a closed insulated system are fulfilled. The signal structure of the given space is examined, and it is shown that the Schwarzschild surface is a pure singularity. (tr-auth)

12990 DETERMINING THE LAGRANGIAN OF A TETRAD, GRAVITATIONAL FIELD. Tunyak, V. N. (Belorussian State Univ., Minsk). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 1, 91-94 (1975). (In Russian).

By requiring a correspondence with Newton's gravitational theory and the Lorentz-covariant theory of nongravitational matter, and also by establishing the simplest possible form of the linear approximation of the field equations, it was possible to obtain a definite determination of the gravitational lagrangian of the tetrad theory of gravitation, containing two characteristic constants, which are the Einstein gravitational constant and a specific, dimensionless "teleparallel" constant $\omega = -1$. (SJR)

12991 DETERMINING THE SOURCES OF A TETRAD, GRAVITATIONAL FIELD. Tunyak, V. N. (Belorussian State Univ., Minsk). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 1, 94-97(1975). (In Russian).

This study shows that the correct determination of the sources of a tetrad gravitational field in the form of a summed, canonical tensor of the energy–momentum of nongravitational matter in a corresponding space of absolute parallelism requires the exclusion of additional terms of Pellegrini-Pleban'skii. (SJR)

12992 HORIZONTAL PATHS AND "PRECESSION OF TOMAS" IN GRAVITATIONAL THEORY. Lapkovskii, A. K.; Laptinskii, V. N. Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 1, 98-101(1975). (In Russian).

For gravitational theory a look is taken at the reconstruction of an arbitrary path in a space of orthonormalized reference points to a horizontal path. On considering small-parameter paths of a third order, the relation to a relativistic effect called the "precession of Tomas" is investigated. From the relations it is possible to compare qualitatively the parallel transfer with the Fermi–Volker transfer. (SJR)

12993 MASSIVE SPHERES WITH THREE VARIABLE-DENSITY DISTRIBUTIONS IN GENERAL RELATIVITY. Krori, K. D.; Borgohain, P. (Cotton Coll., Gauhati, India). Indian J. Pure Appl. Phys.; 12: No. 12, 854-855(Dec 1974).

Tolman's solutions IV, V, and VI of Einstein's field equations for fluid spheres are applied to describe two classes of spheres with three variable density distributions. The conditions under which these solutions for the spheres become physical are discussed, and astrophysical implications of these deductions are indicated. (auth)

12994 MAGNETIC ENERGY AND CYLINDRICALLY SYMMETRIC DISTRIBUTION OF MATTER IN EQUILIBRIUM IN GENERAL RELATIVITY. Krori, K. D.; Barua, J. (Cotton Coll., Gauhati, India). Indian J. Pure Appl. Phys.; 12: No. 12, 818-822 (Dec 1974).

Solutions of Einstein–Maxwell equations corresponding to cylindrically symmetric distribution of conducting matter having stresses with an axial magnetic field were found which can be matched with an outside pure magnetic field originally due to W. B. Bonnor [Proc. Phys. Soc., 67A (1954), 225]. (auth)

12995 DISPERSION OF GRAVITATIONAL WAVES IN A RELATIVISTIC GAS. Ignat'ev, Yu. G. (Kazan State Univ.). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 12, 136-142(1974). (In Russian).

The propagation of gravitational waves is considered in a relativistic gas which in the unperturbed state was in a static gravitational field. Calculations are made of the group velocity of radial gravitational waves and of the decrements of collision and collisionfree dampening. (SJR)

12996 GEODESIC DEVIATIONS IN KERR SPACE. Dozmorov, I. M.; Lutsenko, G. V. Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 12, 142-145(1974). (In Russian).

A study is made of the structure of the sources of gravitational field of Kerr and Schwartzschild spaces by means of the method of geodesic deviation. In Schwartzschild space the deviation is calculated for isotropic and timelike congruences. In Kerr space it is calculated for two isotropic congruences. An analysis of the deviation is carried out. (SJR)

12997 PHYSICAL INTERPRETATION OF PARAMETERS IN THE GENERALIZED SOLUTION OF KERR–NUT. I. Semenov, V. P. Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 12, 146-151(1974). (In Russian).

A look is taken at the problem of interpreting the parameters in the generalized solution of Kerr-NUT on the basis of investigating the dynamic characteristics of a field corresponding to a given solution. It is shown that the treatment of parameters differs in some aspects from the generally accepted treatment. The view is advanced that the reason for this treatment is the unsuccessful selection of a reference system used in obtaining the dynamic characteristics of the field. (SJR)

12998 RELATIVISTIC DYNAMICS OF A SYSTEM OF GRAVITATING PARTICLES. Brezhnev, V. S. Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 12, 151-152(1974). (In Russian).

A generally covariant relativistic dynamics is constructed for a system of gravitating particles with the slowdown in the gravitational interaction being taken into account. To accomplish this purpose a formalism is developed for the vector of the finite displacement in an arbitrary Riemann space. (SJR)

12999 COMPENSATION, NONLINEARITY, AND GEOMETRY. Sardanashvili, G. A. (Moscow State Univ.). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 12, 128-134(1974). (In Russian).

A new approach is given to the theory of compensating fields which is extended to the case of an arbitrary Lie group and which leads to a nonlinear field theory describing the interaction of physical fields and the generation of a noneuclidian geometry of space-time by this interaction. Thus a well known result of Einstein's theory on the relation of geometry and matter is generalized. The application of this theory is given for a series of groups. (SJR)

13000 PRINCIPLES OF A NON-HOLONOMICALLY COVARIANT FORMULATION OF GENERAL RELATIVITY THEORY. Mirianashvili, M. M.; Kiriya, V. S.; Kereselidze, A. B. (Tbilisi State Univ., USSR). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 12, 55-60(1974). (In Russian).

The physical principles of a nonholonomic formulation of general relativity theory are determined. The role of the Fok–Ivanenko coefficients are pointed out in establishing and developing the tetrad formalism of general relativity theory. A determination is given of the physical and geometrical sense of nonholonomic transformations which are used in general relativity theory. (SJR)

13001 GRAVITATIONAL-INERTIAL WAVES IN VACUUM. Linear Approximation. Borisova, L. B.; Zakharov, V. D. Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 12, 106-113(1974). (In Russian).

With the use of the method of chronometric invariants of Zel'manov an approach is developed to describe the gravitational inertial waves of a selected system of reference. It is shown that two theoretically different types of gravitational-inertial waves exist in vacuum. Both types of gravitational-inertial waves are considered in general relativity theory as a linear approximation. (SJR)

13002 SEARCH FOR CONTINUOUS GRAVITATIONAL RADIATION. Hough, J.; Pugh, J. R.; Bland, R.; Drever, R. W. P. (Univ. of Glasgow). Nature (London).; 254: No. 5500, 498-501(10 Apr 1975).

Reference is made to work in Nature 246: 340 (1973) which gave the results of a search for short pulses of gravitational radiation carried out with two detectors operating in coincidence over a frequency range of 650 to 1450 Hz. Detectors of this type may also be used to set upper limits to gravitational radiation fluxes of either continuous or incoherent wave form, and the latter may include pulses which occur at a high rate but are too small to be detected individually. A preliminary experiment is described designed to search for any such signals. The apparatus was tested for two types of radiation and upper limits were set. The radiations were continuous monochromatic radiation, as may be produced by a rapidly rotating neutron star, and broad band gravitational radiation. A description is given of the construction and mode of operation of the detectors. Results are discussed, particularly in relation of those of other workers. (UK)

13003 SPECTRAL DENSITY OF EIGENVALUES OF THE WAVE EQUATION AND THE VACUUM POLARIZATION. Sakharov, A. D. (Lebedev Inst. of Physics, Moscow). Teor. Mat. Fiz.; 23: No. 2, 178-190(May 1975). (In Russian).

The effective Lagrangian of the vacuum polarization is expressed in terms of spectral density of eigenvalues of the wave equation and five-dimensional Green function introduced by V. A. Fock in his method of the 5-th coordinate. The method can be applied for external fields of arbitrary strength but only if the interaction of vacuum fields is neglected. The calculations for the case of vacuum polarization by gravitational and electromagnetic fields are performed. (auth)

13004 SUGAWARA MODEL IN GENERAL RELATIVITY. A. The Case for Three Current Vectors (SU(2)). Tauber, G. E. (Tel Aviv Univ., Israel). Int. J. Theor. Phys.; 11: No. 3, 175-185(Nov 1974).

A general method of solving the equations of Sugawara's field theory of currents (Phys. Rev.; 170: 1659 (1968)) was developed, and illustrated by applying it to the set of three currents. These are inserted into Einstein's field equations which were solved together with the co-variant "gauge" conditions for a gravitational field involving cylindrical symmetry. A further transformation exhibits the triad formed by the current vectors and exhibits clearly the deviations of the line-element from Schwarzchild's exterior solution. (auth)

13005 GRAVITATIONAL RADIATION DURING COULOMBIC COLLISIONS. Gal'tsov, D. V.; Grats, Yu. V. (Moscow State Univ.). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 12, 94-99(1974). (In Russian).

A look is taken at the problem of gravitational bremsstrahlung radiation during collisions of nonrelativistic charged particles at arbitrary values of the Born parameter $|e_1e_2|/\hbar v$ (with exact Coulombic wave functions). It is shown that existing estimates for bremsstrahlung gravitational radiation from a solar plasma are far too high, being based on formulas for cross sections which are not applicable at the given temperature. A new estimate of the bremsstrahlung gravitational radiation from the solar plasma is given. (SJR).

13006 CAN THE EFFECT OF DISTANT MATTER ON PHYSICAL OBSERVABLES BE OBSERVED. Ohta, T. (Seikei Univ., Tokyo); Kimura, T.; Hiida, K. Nuovo Cim., 27B: No. 1, 103-120(11 May 1975).

The effects of distant matter on physical observables are discussed under the assumption that the distribution of distant matter is isotropic. The behaviors of light rays and radar signals near a massive star and the motion of a two-body system and the gravitational red-shifts of light rays emitted from a massive star, which is surrounded by distant matter are investigated. It is shown that the clock and the scale are affected by distant matter and then the effects on the physical observables become unobservable. (auth)

13007 BIFURCATE NONDIVERGING NULL HYPERSURFACES AND TRAPPED SURFACES. Demmie, P. N. (Univ. of Pittsburgh, Johnstown). J. Math. Phys. (N.Y.); 16: No. 5, 1093-1103(May 1975).

An empty space-time containing a bifurcate nondiverging null hypersurface is investigated, and conditions are given that are necessary and sufficient for the existence of trapped surfaces near this hypersurface to its future. These conditions involve a topological requirement that the two-surface of bifurcation be compact and an inequality that must be satisfied by the characteristic data for this spacetime-- the metric of the two-surface of bifurcation and an arbitrary function given on this surface that is shown, to be related to angular momentum. The existance of a bifurcate Killing horizon in this space-time is established. Finally, a Kerr space-time containing bifurcate Killing horizons is examined, and results pertaining to the existence of trapped surfaces near these horizons to their futures are obtained. These results involve the parameters representing mass and angular momentum per unit mass. (auth)

13008 GRAVITATIONAL RADIATION-REACTION EFFECTS IN A STAR–PLANET SYSTEM. Petterson, J. A. (Yale Univ., New Haven). Phys. Rev., D.; 11: No. 2, 253-256(15 Jan 1975).

A star-planet system is considered in which the planet's circular orbit shows a "precession of the nodes" caused by a mass quadrupole moment in the star. The radiation-reaction effects of the gravitational waves emitted by the system is calculated. Besides the well known gradual fall of the planet towards the star, a change in the angle between the equatorial plane of the star and the orbital plane of the planet is found. For oblate stars the angle decreases to zero; for prolate stars it tends toward pi/2. (auth)

REACTOR TECHNOLOGY AND REGULATION

13009 NUCLEAR ENERGY IN THE POWER SYSTEM. Czosnowski, S. Energetyka; 27: No. 11, 364-368(Nov 1973). (In Polish).

The paper presents main events exploring the history concerning nuclear physics and power engineering. It discusses principles of nuclear reactor operation, its main elements and classification, and shows typical nuclear power station arrangements with all their advantages and faults. (Elec. Electron. Abstr.)

13010 SITE REPORTS. A World Round-up of Progress at Nuclear Power Station Sites. Nucl. Eng. Int.; 20: No. 228, 345-371(Apr 1975).

A report is presented of the progress at nuclear power stations throughout the world for reactors under construction and those in course of commissioning. A brief summary is given of the status at each site for the countries of Europe, USA, Canada, Japan, Brazil, and Taiwan. (UK)

13011 TRANSACTIONS OF THE AMERICAN NUCLEAR SOCIETY 1975 ANNUAL MEETING, NEW ORLEANS, LOUISIANA, JUNE 9-13, 1975. Farmakes, R. (ed.). Trans. Am. Nucl. Soc.; 21: 1-552(Jun 1975).

Each of the 547 brief summaries included is listed by title in NSA. The summaries cover sessions on aerospace and hydrospace, controlled nuclear fusion, education, environmental sciences, isotopes and radiation, materials science and technology, mathematics and computation, nuclear criticality safety, nuclear fuel cycle, nuclear reactor safety, power, reactor operations, reactor physics, and shielding and dosimetry. (DCC)

For abstracts of individual papers see: 11137, 11141-11151, 11169, 11188, 11199, 11205, 11224, 11247, 11248, 11256-11258, 11264-11269, 11280-11283, 11302, 11303, 11328-11386, 11419-11426, 11435, 11471, 11475-11478, 11488-11491, 11503, 11507, 11516-11521, 11525-11530, 11537-11540, 11550, 11552, 11553, 11555, 11573-11577, 11591, 11602-11605, 11617, 11619-11623, 11639-11643, 11663, 11664, 11669, 11674, 11730, 11731, 11748, 11848, 11890, 11960-11962, 11996-11999, 12026, 12093, 12094, 12163-12172, 12213, 12214, 12225-12243, 12251-12256, 12258-12260, 12265, 12266, 12279, 12291, 12731-12743, 12787, 12843-12848, 12884-12889, 12919, 12920, 12935, 13012-13020, 13032-13045, 13071-13095, 13107-13113, 13164-13167, 13191-13235, 13248-13270, 13273, 13425, 13426, 13468-13569, 13580-13603, 13610-13620, 13631-13635, 13649-13660, 13668-13670, 13678-13680, 13685-13694, and 13697.

13012 REACTOR CONSTRUCTION MANAGEMENT CAN/SHOULD BE TAUGHT IN ENGINEERING SCHOOL. Coulbourn, G. I. (Consolidated Edison Co., New York, NY). Trans. Am. Nucl. Soc.; 21: 74(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13013 EVOLUTION OF A COMPUTER-CODE-ORIENTED REACTOR DESIGN COURSE. Almenas, K.; Munno, F. J. (Univ. of Maryland, College Park, MD). Trans. Am. Nucl. Soc.; 21: 74-75(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13014 GRADUATE TRAINING PROGRAM IN EXPERIMENTAL REACTOR PHYSICS. Holland, L. (Instituto de Energia Atomica, Sao Paulo, Brazil); Shalev, S. Trans. Am. Nucl. Soc.; 21: 75-76 (Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13015 APPLICATION OF INDIVIDUAL PROBLEMS IN UNDERGRADUATE NUCLEAR ENGINEERING. Massey, J. V.; Carlson, R. W. (Georgia Inst. of Tech., Atlanta). Trans. Am. Nucl. Soc.; 21: 77-78(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13016 VIEW ON THE INDUSTRIAL NEEDS FOR DEVELOPING QUALITY-CONSCIOUS PROFESSIONALS. Wachniak, R. (Babcock and Wilcox Co., Lynchburg, VA). Trans. Am. Nucl. Soc.; 21: 80-81(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13017 QUALITY ASSURANCE REQUIREMENTS IN THE ENGINEER/CONSTRUCTOR ORGANIZATION. Bernsen, S. A. (Bechtel Corp., San Francisco). Trans. Am. Nucl. Soc.; 21: 81-82(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13018 MASTERS PROGRAM IN QUALITY: A VIEW ON ACADEMIC INVOLVEMENT. Marguglio, B. W. (Aerojet Nuclear Co., Idaho Falls, ID). Trans. Am. Nucl. Soc.; 21: 82-83(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13019 QUALITY ASSURANCE NEEDS AS VIEWED BY A UTILITY. Banks, H. R. (Carolina Power and Light Co., Raleigh, NC). Trans. Am. Nucl. Soc.; 21: 83-84(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13020 QUALITY ASSURANCE TRAINING BASED ON USNRC EXPERIENCE. Vollmer, R. H. (Nuclear Regulatory Commission, Washington, DC). Trans. Am. Nucl. Soc.; 21: 84-85(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13021 GROWTH OF NUCLEAR POWER AND THE SYSTEMS INVOLVED. (International Atomic Energy Agency, Vienna). pp 1-9 of Neutron Irradiation Embrittlement of Reactor Pressure Vessel Steels. Steele, L. E. Vienna; International Atomic Energy Agency (1975).

See STI/DOC-10/163.

The pressure on limited fossil fuels has forced a massive world-wide turning to nuclear fuel for energy needs; 328 reactors are either operable, under construction, or planned. The reactors are tabulated according to country; capacity and type are listed. Reactor types and pressure containments are discussed. (DLC)

13022 REPORT ON BUILDING PROJECTS AND PLANS IN EUROPE. I. New Nuclear Power Stations in the Federal Republic of Germany. Atomwirtsch., Atomtech.; 20: No. 3, 135-151(Mar 1975). (In German).

12 figs.; 3 tabs.

Data are given on the nuclear power stations of the FRG in operation, under construction or projected. (GE)

13023 KERNTECHNIK. Begriffe. Entwurf. (Nuclear Technology. Terms and Definitions. Draft). Berlin; Beuth (1974). 12p.

Collection of terms from the nuclear technology field and their translations into the English, French, Italian, Russian and Dutch languages is presented. (GE)

Power Reactors, Non-Breeding, BWR-Type

Refer also to abstracts 13436, 13437, 13443, 13447, 13457, 13482, 13485, 13489, 13490, 13495, 13498, 13543, 13544, 13546, 13548, 13550-13554, 13650, and 13690.

13024 (ERDA-tr-7) STEAM GENERATOR INSTALLATIONS FOR NUCLEAR POWER STATIONS. Rassokhin, N. G. May 1975. Translation of Parogeneratornye Ustanovki Atomnykh Electrostantsii, Atomizdat, Moscow, 1972. 360p. Dep. NTIS $10.60.

This book presents diagrams and construction details for steam generators for nuclear power stations of different types. Consideration is given to hydrodynamics, heat-exchange processes, and physico-chemical processes taking place in steam production. Methods for structural calculations are given. The book is designed for students in the special field of atomic electrical stations and installations and corresponds to the program for the appropriate courses. It may be used by students and other specialists involved in atomic energy. It is of definite interest also for specialists and for workers in the field of atomic energy. 56 references. (auth)

13025 (EUR-5294e) VIBRATION AND NOISE ANALYSIS IN NUCLEAR POWER PLANTS. (Allianz-Zentrum fuer Technik G.m.b.H. (AZT), Ismaning/Muenchen (F. R. Germany); Electricite de France, 75 - Paris; Ente Nazionale per l'Energia Elettrica, Rome (Italy); Laboratoire Belge de l'Industrie Electrique (LABORELEC), Linkebeek (Belgium); Technische Univ. Hannover (F. R. Germany); Technische Univ. Muenchen (F. R. Germany). Lehrstuhl fuer Reaktordynamik und Reaktorsicherheit). 1974. 288p. Dep. NTIS (US Sales Only) $17.75. EUR B. Fr. 600,-.

Results of investigations on noise and vibration analysis are presented. The state of the art in on-load surveillance techniques of light water reactors is given by extending the preceding studies to investigations of boiling water reactors and by summarizing the latest results of pressurized water reactors, the basis being experimental and theoretical work performed by the different organizations. Finally, some developments with respect to measurement and identification methods are discussed. (auth)

13026 (NEDO-20377) 8 x 8 FUEL BUNDLE DEVELOPMENT SUPPORT. (General Electric Co., San Jose, Calif. (USA). BWR Projects Dept.). Feb 1975. 47p. General Electric Co., San Jose, CA.

A description and the results of all tests performed on 8 x 8 fuel bundles or other lattices which provide data on the performance of 8 x 8 bundles for GE BWRs are presented. It is shown that sufficient experimental and test data exist to support use of 8 x 8 fuel in operating GE Boiling Water Reactors. 36 references. (auth)

13027 POSSIBILITY OF USING KU-2 CATION RESIN FOR POLISHING CONDENSATES AT HIGHER TEMPERATURES. Subbotina, N. P.; Zorin, V. M. (Moscow Power Inst.). Therm. Eng.; 21: No. 7, 8-10(Jul 1974).

Translated from Teploenergetika; 21: No. 7, 7-8(Jul 1974).

Problems in using the KU-2 resin for condensate polishing in water cooled nuclear power plants are discussed. (JWR)

13028 STEAMHAMMER PROBLEMS: DYNAMIC SHOCK LOADING OF CRITICAL REACTOR PIPING SYSTEMS. McGeorge, R.; Swec, L. F. Jr. (EDS Nuclear Inc., San Francisco). Nucl. Eng. Des.; 32: No. 1, 121-128(Apr 1975).

The evaluation of the pressure and momentum transients resulting from sudden valve operation is presented, and the dynamic response of the piping to the induced transient loading is analyzed. The characteristics of the transient conditions existing immediately following both sudden valve opening and closure as encountered in BWR and PWR plants are discussed. The procedures used to calculate the transient time history functions are outlined. The derivation of the loading induced in the piping by the pressure and momentum transients is discussed and the determination of the dynamic response of the piping is presented. The procedures described are illustrated by actual examples from BWR and PWR plants, and the significance of steamhammer effects relative to other loading conditions is discussed. (auth)

13029 STATIC AND HEAT TRANSFER ANALYSIS OF A SPHERE-CONE INTERSECTION IN A NUCLEAR CONTAINMENT VESSEL. Miksch, M. (Kroftwerk Union AG, Erlangen, Ger.); Mera, A. Int. J. Pressure Vessels Piping.; 3: No. 1, 27-42(Jan 1975).

Structural analyses for nuclear power plants require advanced computational techniques such as computer codes derived from thin shell theory and the finite element method. The steel containment shell of a KWU boiling water reactor, type 69, has an integrated pressure suppression system. A considerable number of loading cases, including mechanical and thermal effects, were investigated. Several models were used for the analysis: an axisymmetric BOXSHELL-model was prepared for the overall structure; a sector of 3.75 degrees was idealized with ASKA; and stress concentrations at the sphere-cone intersection of the containment vessel were calculated using a detailed NASTRAN model; boundary conditions were made compatible with the overall BOXSHELL-model. (auth)

13030 AUTOMATIC SAFETY CONTROLS IN NUCLEAR POWER STATIONS USING LIGHT WATER AS THE ENERGY CARRIER. Moeller-Jepsen, J. C. Energy World.; No. 15, 17(Apr 1975).

In nuclear power stations which use light water as the energy carrier it is necessary that radioactive water or steam should be carried in pipes, and consequently there is need for automatic safety controls which would immediately function in the event of leakage. The automatic controls used in the power stations at Oskarshamn and Ringhals in Sweden, where ASEA-ATOM BWR reactors have been installed, are described. (auth)

13031 THREE-DIMENSIONAL CRACK ANALYSIS APPLIED TO AN LWR NOZZLE-CYLINDER INTERSECTION. Hellen, T. K.; Dowling, A. R. (Central Electricity Generating Board, Berkeley, Eng.). Int. J. Pressure Vessels Piping; 3: No. 1, 57-74(Jan 1975).

Evaluations of the stress intensity factors around the profiles of four crack configurations at the inner crotch corner of a typical LWR nozzle-cylinder intersection in the pressure vessel are described. Three-dimensional finite element techniques are used, incorporating such recent developments to enhance the accuracy of the computed results as quadratic isoparametric elements with special singularity elements around the crack profile and a virtual crack extension method. Comparison with an alternative finite element set of results and suitable bounding approximate solutions are made. (auth)

13032 IMPLEMENTATION SLICING TECHNIQUE FOR GE BWR LATTICE CALCULATION. Choong, P. T. (General Electric Co., San Jose, CA). Trans. Am. Nucl. Soc.; 21: 221-222 (Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13033 RAPID EMPIRICAL METHOD FOR MULTICYCLE FUEL COST ANALYSIS. Forbes, I. A. (Lowell Technological Inst., MA); Muckerheide, W. A.; Chunis, J. A.; Pilat, E. E.; Filippone, W. L. Trans. Am. Nucl. Soc.; 21: 257-258(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13034 INCREMENTAL COST ANALYSIS IN THE NUCLEAR FUEL CYCLE. Forbes, I. A. (Lowell Technological Inst., MA); Chunis, J. A.; Muckerheide, W. A.; Turnage, J. C.; Brown, G. J. Trans. Am. Nucl. Soc.; 21: 258-259(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13035 PLUTONIUM RECYCLE STRATEGIES FOR LIGHT-WATER THERMAL REACTORS. Skoorka, B. M.; Malaviya, B. K. (Rensselaer Polytechnic Inst., Troy, NY). Trans. Am. Nucl. Soc.; 21: 259(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13036 EFFECTS OF PLUTONIUM UTILIZATION ON REACTOR PERFORMANCE. Meyer, R. O.; Wood, P. M.; Sheaks, O. J. (Nuclear Regulatory Commission, Washington, DC). Trans. Am. Nucl. Soc.; 21: 328-329(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13037 EXPERIENCE OF OTHERS CAN IMPROVE YOUR NUCLEAR PLANT RELIABILITY. Calhoun, J. R.; Draper, B. D. (Tennessee Valley Authority, Chattanooga). Trans. Am. Nucl. Soc.; 21: 371-372(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13038 RETROFITTING AN OPERATING NUCLEAR POWER PLANT RADWASTE SYSTEM. Doyle, R. D. (Ebasco Services, Inc., Norcross, GA). Trans. Am. Nucl. Soc.; 21: 438-439(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13039 LIQUID AND SOLID RADWASTE EXPERIENCE AT THE NINE MILE POINT BWR. Burns, R. A. (Niagara Mohawk Power Corp., Lycoming, NY). Trans. Am. Nucl. Soc.; 21: 439 (Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13040 RECENT RADWASTE OPERATING EXPERIENCE AT DRESDEN STATION. Worden, W. P. (Commonwealth Edison Co., Chicago). Trans. Am. Nucl. Soc.; 21: 439-440(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13041 RADIATION EXPOSURE ASSOCIATED WITH MAINTENANCE ACTIVITIES AT NUCLEAR POWER PLANTS. Pelletier, C. A.; Murri, E. L. (Nuclear Environmental Services, Rockville, MD). Trans. Am. Nucl. Soc.; 21: 442(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13042 EVALUATION OF RADWASTE VOLUME REDUCTION. Fairchild, P. D.; Benfield, R. A. (Ebasco Services, Inc., Norcross, GA). Trans. Am. Nucl. Soc.; 21: 445(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13043 IN-CORE NEUTRON DETECTOR RESPONSE MODEL BASED ON BASIC PRINCIPLES. Hannaman, G. W. (General Atomic Co., San Diego, CA); Danofsky, R. A. Trans. Am. Nucl. Soc.; 21: 479-480(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13044 CORE MONITORING AT THE OYSTER CREEK REACTOR. Bond, G. R. (GPU Service Corp., Parsippany, NJ); Fickeissen, K. O. E. Trans. Am. Nucl. Soc.; 21: 485-486(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13045 MEASUREMENTS OF FISSILE MATERIAL CONTENT IN LWR SPENT FUEL. Gozani, T. (Science Applications, Inc., La Jolla, CA). Trans. Am. Nucl. Soc.; 21: 488-489(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13046 NUCLEAR FUEL PERFORMANCE. Proceedings of the International Conference Held at London, England, October 15–19, 1973. London; British Nuclear Energy Society (1973). vp. (CONF-731004-).

Separate abstracts are included for each of the 91 papers presented concerning water reactor fuel performance, AGR fuel performance, HTGR fuel particle performance, HTGR graphite and matrix materials, Magnox fuel performance, HTGR fission product characteristics, and fuel safety aspects. (DCC)

For abstracts of individual papers see: 11963, 11964, 13047–13062, 13096–13100, 13114–13161, 13168–13176, 13274, 13570, 13571, and 13636–13643.

13047 PRODUCTION AND PERFORMANCE OF PLUTONIUM ENRICHED THERMAL REACTOR FUEL. Robertson, R. I. (BNFL, Windscale, Eng); Gibson, I. H. pp 53.1-53.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

An increasing interest is being shown in the recycling of plutonium in thermal reactors. The physics performance calculations for light water reactors are presented with the requirements for both enriched uranium and plutonium fuels. The principle features of the codes used are described and the application of these methods to the analysis of experiments on Pu containing BWR lattices carried out at AEE Winfrith and to fuel management calculations is explained. At the Windscale Works of BNFL, the manufacture of small batches of Pu enriched thermal reactor fuel has been carried out on an experimental production line. Experience has been gained in the fabrication of fuel for LWR's, HWR's and gas cooled reactors in both the UK and various European countries including Germany, Italy, Belgium and Sweden. In order to compare the performance of mixed oxide fuel with that of UO_2 fuel these were manufactured to designs and specifications resembling as close as possible those of the UO_2 fuel elements they were meant to replace. The problems raised in the manufacture are discussed and the overall performance of the fuel elements which have been manufactured and irradiated in the various reactors is outlined where possible. (auth)

13048 CREEP AND DENSIFICATION OF UO_2 UNDER IRRADIATION. Brucklacher, D.; Dienst, W. (Kernforschungszentrum, Karlsruhe, Ger.). pp 60.1-60.3 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

Fuel dimensional changes can result from fuel swelling and from densification by sintering under irradiation. Swelling could be accomodated by irradiation-induced creep under cladding restraint. Fuel swelling rates were measured on UO_2 at low temperatures. Data on UO_2 sintering under irradiation were obtained by various measurements and are compared with out-of-pile results. At low temperatures sintering is enhanced by irradiation up to 1300°C. But UO_2 pellets of an original density above 96% TD will not show any considerable densification. In-pile creep experiments on UO_2 were performed at fuel temperatures between 250 and 850°C. The creep rates are proportional to stress and also to fission rate and are only slightly dependent on temperature. Results are discussed with regard to mechanical interaction between fuel and cladding. 5 references. (auth)

13049 IRRADIATION OF PLUTONIUM BEARING FUEL CLAD WITH ZIRCALOY. Bairiot, H.; Deramaix, P.; Hoppe, N.; van Outryve d'Ydewalle, B. (Belgonucleaire, Brussels). pp 61.1-61.9 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

As the plutonium content in mixed oxide fuels for thermal reactors is relatively small, only limited changes are expected in their behavior as compared to uranium fuels. This assumption has been successfully confirmed by experiments initiated by BELGONUCLEAIRE ten years ago on mixed oxide fuels, first with stainless steel cladding and later on with Zircaloy cladding. The objectives, the experimental approach and the investigated parameters of the demonstration programme are described; e.g., most of the rods are irradiated in typical LWR conditions, but special attention is also paid to determine the operational limits. Reliability, fabrication costs and flexibility to meet various requirements or to modify some objectives were the main guidelines; these features provide the necessary basis for improving fuel specifications and for evaluating the manufacturing variables of the industrial products. The status of the programme as to the end of June 1973 is described and examples of results are presented. Small differences as compared to UO_2 are found and the present experience confirms the UO_2-PuO_2 as an adequate fuel in Zircaloy clads for LWR's. (18 references) (auth)

13050 EFFECTS OF TEXTURE AND ANNEALING TEMPERATURE ON PLASTIC DEFORMATION BEHAVIOR OF ZIRCALOY-2 FUEL CLADDING TUBE. Maki, H.; Ooyama, M.; Okubo, T.; Mishima, Y. (Hitachi Ltd, Tokyo). pp 62.1-62.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

The deformation behavior under various stress conditions has been studied on Zircaloy-2 fuel cladding tube from six batches with various textures and final annealing conditions. The anisotropic theory of plasticity proposed by Hill was found to be applicable to understand qualitatively the plastic deformation behavior under bi-axial stress conditions. The correlation between effective stress and effective strain shows a linear relationship on the logarithmic plot, but strong anisotropy was observed in work hardening characteristics. The effect of texture and final annealing temperature on fracture behavior has also been observed. (5 references) (auth)

13051 BEHAVIOR OF UO_2–Gd_2O_3 FUEL. Wada, T.; Noro, K.; Tsukui, K. (Toshiba Research and Development Center, Japan). pp 63.1-63.3 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

Some basic properties at high temperatures and in reactor behavior of UO_2–Gd_2O_3 fuel were studied. A single phase UO_2-Gd_2O_3 solid solution could be attained at relatively low temperature when co-precipitated powder was used. The difference of thermal expansion coefficient of UO_2 and UO_2–Gd_2O_3 solid solution in the composition range 0 to 8 wt % of Gd_2O_3 was negligibly small. No migration of Gd_2O_3 in UO_2–Gd_2O_3 pellets was observed when annealed at thermal gradients to 1,350°C and hot end temperatures to 2,100°C. In order to make clear the phase relationship, measurements were made in the composition range between 0 and 30 wt % Gd_2O_3. The fuel pin containing UO_2-3 wt % Gd_2O_3 pellets, irradiated in Japan Material Test Reactor (JMTR) with calculated maximum center temperature 2,280°C, revealed very different microstructures from those usually observed in irradiated UO_2 pellets. (6 references) (auth)

13052 ANALYSIS OF THE EFFECTS OF DISPERSED PARTICLES AND IRRADIATION ON THE DEFORMATION BEHAVIOR OF Zr-2. Singh, B. N. (Danish Atomic Energy Commission, Risco); Warren, M. R.; Parsons, P. D. pp 64.1-64.3 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

Irradiated and unirradiated Zr-2 specimens with or without dispersions of inert particles have been tensile tested at 250 and 350°C. The onset of premature work softening in irradiated alloys is postponed by the presence of particles. This is discussed in terms of the effects of irradiation induced defects and particles on dislocation mobility and structure. It is concluded that at 250°C the major effect stems from vacancy-dislocation interactions, whereas at 350°C the effects of dislocation loops and vacancy annealing assume more dominant roles. (11 references) (auth)

13053 PRODUCTION OF BURNABLE POISON OXIDE FUEL. Littlechild, J. E.; Butler, G. G.; Lester, G. W. (BNFL, Springfields, Eng.). pp 65.1-65.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

In recent years there has been increasing consideration and application of burnable poison fuels in nuclear reactors, particularly in LWR's. This type of fuel enables a more constant core reactivity with time to be achieved by using high neutron capture cross section additives which absorb neutrons and revert to lower cross section nuclides at a similar rate to that at which the overall fissile reactivity is dropping due to burnup. The main criteria for the selection of burnable poisons are a

neutron capture cross section which will ensure burnout at the correct rate, the absence of objectionable daughter products after irradiation, and the compatibility of the burnable poison and any daughter products with the fuel and clad under reactor operating conditions. (auth)

13054 BWR FUEL TESTING AT GENERAL ELECTRIC: AN OVERVIEW. Loyns, M. F.; Rowland, T. C.; Weiss, D. T. pp 68.1-68.18 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

A brief review is presented of the experimental facilities and of all major BWR fuel testing programs performed at General Electric and the significant conclusions and actions resulting from each project, including the more recent studies of UO_2 swelling and localized hydriding. The investigation of the pellet-clad interaction mechanism is an ongoing effort and a status report is provided. (auth)

13055 BWR FUEL EXPERIENCE. II. Correlation of Fuel Performance to Manufacturing Variables. Garzarolli, F.; Boos, B.; Guse, K.; Niehoff, P. (Kraftwerk Union AG, Frankfurt am Main). pp 71.1-71.3 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

It can be stated that the overall performance of the German BWR reactors Kahl (VAK), Lingen (KWL) and Gundremmingen (KRB) was quite satisfactory as no plant was faced with the operational restrictions due to fuel failures. Nevertheless the failure rate which has been reported over the past years from many sides is of great concern to all parties involved. In order to learn the cause of the fuel defects KWU collected information by several approaches. Results are summarized. (auth)

13056 BWR FUEL EXPERIENCE. I. Correlation of Fuel Performance to Operational History. Niehoff, P.; Von Jan, R. F. (Kraftwerkunion AG, Frankfurt am Main). pp 74.1-74.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

Methods for a statistical evaluation of reactor fuel performance are discussed, in particular with respect to the dependence of the fuel reliability on exposure and power history. The analysis of 1st core fuel performance in German BWR's shows that the observed failures should be due to substandard fuel quality. There is no indication of a basic and life time limiting failure mechanism related to operational mode or exposure. (auth)

13057 FUEL COLUMN SHORTENING IN IRRADIATED UO_2-Zr FUEL PINS. List, F.; Bryndum, K.; Knudsen, P. (Danish Atomic Energy Commission, Riso). pp 75.1-75.3 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

Fuel column shortening in irradiated UO_2-Zr BWR-type fuel pins apparently resulted from fuel-clad mechanical interaction during successive irradiation periods, and a model was set up accordingly. A cladding examination enabled the determination of local pellet displacements which agreed well with model predictions. Isotropic densification did not appear to play any significant role in the shortening process. (auth)

13058 QUALITY COSTS OF ZIRCALOY CLADDING TUBES. Rose, R.; Granlund, A. (A/S Raufoss Ammunisjonsfabrikker, Raufoss, Norway). pp 78.1-78.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

A variety of tubing properties determined by the fabrication processes are of importance to the inservice integrity of the Zircaloy can. The most important properties are surface treatment and roughness, dimensional tolerances, grain size, corrosion rate, tensile, burst and creep properties, texture and hydride orientation. On the basis values for these properties, as found in present days BWR and PWR cladding tube specifications, an attempt has been made to evaluate the implications of changes in some cladding tube properties, with regard to in-service merits and to production costs. (auth)

13059 BEHAVIOR OF BWR/6 FUEL DURING LOSS-OF-COOLANT CONDITIONS. Scatena, G. J. (General Electric Co., San Jose, CA). pp 85.1-85.5 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

BWR/6 fuel performance is investigated during a postulated loss-of-coolant accident. The possibility of fuel cladding failure mechanisms such as perforations and fragmentation are studied. It is concluded that because of the reduced duty obtained with the improved BWR/6 fuel design, the fuel will neither perforate nor experience fragmentation during the postulated accident. The calculated cladding temperature is more than 300°F below the perforation temperature and the degree of cladding oxidation experienced is greater than a factor of 100 below that necessary to result in fragmentation. (7 references) (auth)

13060 IN-REACTOR MEASUREMENTS OF FUEL STACK SHORTENING. Hanevik, A. (OECD, Halden, Norway); Knudsen, K. D.; Arnesen, P. pp 89.1-89.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

In-reactor measurements of UO_2 fuel stack shortening have been performed on a series of fuel rods with the following variables: pellet structural stability, fuel density, heat rating, and fuel to cladding clearance. The results indicate that the amount of stack shortening is primarily dependent on pellet structural stability. The rate of length change decreases with time (burnup), but stack shortening continues at a burnup of 4000 MWd/t. The effects of heat rating are negligible, and the length change is mainly dependent on burnup (number of fissions). It can be concluded from the measurements that the in-reactor stack shortening can be minimized by modifying pellet fabrication routes to give stable fuel structures. (auth)

13061 INFLUENCE OF VARIOUS METALLURGICAL PARAMETERS AND NEUTRON FLUX ON CREEP OF ZIRCALOY 4 CLADDING TUBES. Frenkel, J. M.; Weisz, M. (CEA, Saclay, France). pp 90.1-90.6 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

The creep strength of cladding tubes is one of the significant parameters in the design of fuel elements of light water reactors. Internal pressure creep tests were made on Zircaloy 4 tubes of some twenty batches differing in manufacturing method. It was noticed that creep strength varied quite widely with the annealing temperature and the cold work level of the tube. A high annealing temperature had a beneficial effect on the transverse creep strength, whereas the effect of high cold working was unfavorable. Completely annealed tubes produced the best results. This annealing effect is linked to an increase in the anisotropy of the material presumably resulting from modifications in texture. Internal pressure creep tests under neutron flux were made in a wide range of temperature and flux (330 to 385°C, 4×10^{13} to 2×10^{14} n/cm^2·s, E > 1 MeV). At high temperature and high flux significant creep acceleration was still observed. Even under flux, the effect of the annealing temperature on the transverse creep strength was very clear. (8 references) (auth)

13062 REVIEW OF WORK CARRIED OUT BY BELGONUCLEAIRE AND CEA ON THE IMPROVEMENT AND VERIFICATION OF THE COMETHE COMPUTER CODE WITH THE AID OF IN-PILE EXPERIMENTAL RESULTS. de Meulemeester, E. (Belgonucleaire, Brussels); Hoppe, N.; de Contenson, G.; Watteau, M. pp 92.1-92.15 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

COMETHE is a computer program developed by BELGONUCLEAIRE to forecast the mechanical and thermal in-pile behavior of a metal-clad fuel pin containing sintered ceramic fuel. At the moment, the program is used for the pins in the "fast neutron" and "light water" systems. COMETHE has already been described at several conferences; the object of the present communication is therefore, to present in a synthetic fashion, the improvements and calibration which have been undertaken by BELGONUCLEAIRE and the CEA. (15 references) (auth)

Power Reactors, Non-Breeding, PWR-Type

Refer also to abstracts 13024, 13025, 13027, 13028, 13031, 13033–13037, 13041, 13042, 13045–13050, 13052, 13053, 13058, 13060–13062, 13251, 13427–13429, 13431–13434, 13436, 13437, 13443, 13454–13457, 13472, 13485, 13489–13492, 13494, 13498, 13543–13550, 13552, 13553, 13555, 13561, 13568, 13647, 13663, 13689, and 13691.

13063 (AED-CONF-75-023-009) PERFORMANCE OF THE COMBUSTION ENGINEERING PWR-PHYSICS DESIGN SYSTEM. Gavin, P. H.; Rickard, I. C. (Combustion Engineering, Inc., Windsor, Conn. (USA). Nuclear Power Dept.). 1975. 9p. INIS.

From KTG-special meeting "long-term behavior"; Stuttgart, F. R. Germany (25 Feb 1975).

The results of core follow calculations performed on a number of combustion engineering and other reactors are presented. The degree of accuracy with which design parameters can be predicted is established. (GE)

13064 (BAW-10100A) REACTOR VESSEL MATERIAL SURVEILLANCE PROGRAM, Compliance with 10 CFR 50, Appendix H, for Oconee Class Reactors. Palme, H. S.; Carter, G. S.; Whitmarsh, C. L. (Babcock and Wilcox Co., Lynchburg, Va. (USA). Nuclear Power Generation Div.). Feb 1975. 64p. Babcock and Wilcox, Lynchburg, VA.

The reactor vessel material surveillance program utilized on B and W 177 fuel assembly reactors (Oconee class) is described for which the surveillance specimens had not been prepared prior to issuance of Appendix H to 10 CFR 50 on July 17, 1973. The purpose of the surveillance program is to monitor changes in fracture toughness properties of reactor vessel beltline region materials. In this program Charpy V-notch, tension, and, in selected cases, half-inch compact tension test specimens are placed in six capsules which contain dosimeters and temperature monitors. The type and number of specimens, and the number of capsules are in accordance with the requirements of Appendix H to 10 CFR 50. The materials selected for surveillance monitoring are those identified as being the materials which will first control the operating limitations of the reactor vessel during its service life. The variables considered for the material selection are listed. 12 references. (auth)

13065 (WCAP-7800(Rev.4-A)) NUCLEAR FUEL DIVISION QUALITY ASSURANCE PROGRAM PLAN. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). Mar 1975. vp. Westinghouse Electric Corp., Pittsburgh, PA.

The Westinghouse quality assurance program for the design, procurement, and manufacturing activities for nuclear fuel assemblies and associated reactor core components is presented. (JWR)

13066 CLEANING COOLANT CONTAINING BORON, AND THE WATER CHEMISTRY OF THE PRIMARY LOOP OF VVER-1 REACTOR. Matskevich, G.V.; Klement'eva, E. M.; Plotnikov, I. M.; Murav'eva, A. G. Therm. Eng.; 21: No. 7, 21-24(Jul 1974).

Translated from Teploenergetika; 21: No. 7, 14-17(Jul 1974).

An investigation on the treatment of the highly radioactive boron concentrate obtained when evaporating the coolant of the primary loop of a WWER-type reactor is described. (JWR)

13067 OPTIMIZING THE WATER CONDITIONS OF THE SECONDARY LOOPS OF NUCLEAR POWER STATIONS WITH WATER-MODERATED WATER-COOLED REACTORS. Margulova, T. Kh.; Prokhorov, F. G.; Ryabova, D. V.; Voronov, V. N.; Nasokina, I. A. Therm. Eng.; 21: No. 7, 1-7(Jul 1974).

Translated from Teploenergetika; 21: No. 7, 1-6(Jul 1974).

An investigation of WWER steam-generator water conditions characterized by the use of condensate polishing in combination with chelating agent treatment of feedwater is described. The technical-economic optimization of water conditions is possible using these methods. (JWR)

13068 INTEGRATED PWR FOR SMALL AND MEDIUM SIZED NUCLEAR POWER PLANTS. Harde, R.; Breyer, W.; Holling, E. (Internationale Atomreaktorbou GmbH (INTERATOM), Bensberg/Koeln, Ger.). Nucl. Eng. Int.; 48-0: No. 20, 48-50 (Jan 1975).

The development and main features of a PWR with integrated cooling system are described. (DG)

13069 PLAN EARLY FOR NUCLEAR IN-SERVICE INSPECTIONS. Bennett, W. F.; Greer, A. S. Power (N.Y.).; 119: No. 6, 108-109(Jun 1975).

Recommendations are made for the planning of a PWR inservice inspection program. The advantages and disadvantages are listed for ultrasonic inspection of pressure vessels from the outside vs. the inside surface. Design and fabrication techniques are mentioned which facilitate satisfactory non-destructive testing. (DG)

13070 METHOD OF SOLVING THE POTENTIAL FIELD IN COMPLICATED GEOMETRIES AND THE POTENTIAL FLOW IN THE LOWER PLENUM OF A PRESSURIZED WATER REACTOR. Yeh, H. C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Nuclear Energy Systems Div.). Nucl. Eng. Des.; 32: No. 1, 85-104(Apr 1975).

A method of obtaining the exact solution for potential field problems with complicated goemetries is presented. It consists of dividing the potential field into several regions and solving the equation in each region by the method of separation of variables. The method is exemplified by solving the potential flow in the lower plenum of a pressurized water reactor. Three geometries are considered: (i) the two-dimensional case, (ii) the cylindrical case, and (iii) the hemispherical case. The result of the two-dimensional case agrees very well with the existing solution obtained by conformal mapping. (auth)

13071 TRITIUM FOLLOW PROGRAM AT OCONEE. Grant, P. J. (Babcock and Wilcox Co., Alliance, OH). Trans. Am. Nucl. Soc.; 21: 177(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13072 CORROSION STUDIES IN THE PRIMARY SYSTEM AT OCONEE I. Kennedy, A. J. (Babcock and Wilcox Co., Alliance, OH). Trans. Am. Nucl. Soc.; 21: 177-178(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13073 B AND W FUEL PERFORMANCE IN THE OCONEE-1 REACTOR. Mayer, J. T.; Montgomery, M. H. (Babcock and Wilcox Co., Lynchburg, VA). Trans. Am. Nucl. Soc.; 21: 186(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13074 THORIUM UTILIZATION IN THE ANGRA DOS REIS PWR (BRAZIL). Correa, F.; Oosterkamp, W. J. (Instituto de Energia Atomica, Sao Paulo, Brazil). Trans. Am. Nucl. Soc.; 21: 261(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13075 DESIGN OF A MICROSEISMIC NETWORK AT A NUCLEAR POWER PLANT. Murphy, J. R.; Lynch, R. D. (Computer Sciences Corp., Falls Church, VA). Trans. Am. Nucl. Soc.; 21: 353(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13076 DYNAMIC SIMULATION OF AN INTEGRAL ECONOMIZER, U-TUBE STEAM GENERATOR. Arwood, D. C. (Tennessee Valley Authority, Knoxville); Kerlin, T. W. Trans. Am. Nucl. Soc.; 21: 369-370(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13077 EXPEDITIOUS STARTUP: A KEY TO INCREASED NUCLEAR POWER PLANT AVAILABILITY. Jensen, R. J.; Leddick, R. S. (Northern States Power Co., Minneapolis). Trans. Am. Nucl. Soc.; 21: 371(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13078 PREDICTING COSTS AND CONTROLLING PROGRESS IN NUCLEAR POWER PLANT CONSTRUCTION. Zink, D. A. (Construction Management Systems, Haddonfield, NJ); Schappa, P. J. Trans. Am. Nucl. Soc.; 21: 401-402(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13079 MOVABLE IN-CORE DETECTOR SYSTEM. Warren, H. D. (Babcock and Wilcox Co., Lynchburg, VA). Trans. Am. Nucl. Soc.; 21: 430-431(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13080 EQUILIBRIUM AND POST-SHUTDOWN XENON REACTIVITY MEASUREMENTS FOR A PRESSURIZED WATER REACTOR. Christenson, J. M. (Univ. of Cincinnati); Jones, P. D.; Palowitch, B. Trans. Am. Nucl. Soc.; 21: 432-433(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13081 PWR TEST AT ABNORMAL OPERATING CONDITIONS AND COMPARISON TO CALCULATIONS. Burke, T. M.; Shefcheck, J.; Meyer, C. E. (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc.; 21: 433-434(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13082 RADIOCHEMISTRY TECHNICAL ASSISTANCE PROGRAMS FOR NUCLEAR POWER PLANTS. Kennedy, A. J.; McDaniel, T. L.; Moore, D. T.; Yochheim, E. D. (Babcock and

Wilcox Co., Lynchburg, VA). Trans. Am. Nucl. Soc.; 21: 434(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13083 RADWASTE SYSTEM PERFORMANCE AT OCONEE. Grant, P. J. (Babcock and Wilcox Co., Lynchburg, VA). Trans. Am. Nucl. Soc.; 21: 440(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13084 RADWASTE OPERATING EXPERIENCE AT CAROLINA POWER AND LIGHT COMPANY'S H. B. ROBINSON NUCLEAR PLANT. Webster, B. H. (Carolina Power and Light Co., Raleigh, NC); Harness, J. L. Trans. Am. Nucl. Soc.; 21: 440-441(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13085 WASTE CONTROL AT GINNA STATION. DeMeritt, E. L. (Rochester Gas and Electric Corp., NY). Trans. Am. Nucl. Soc.; 21: 441(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13086 RADIATION-RELATED MAINTENANCE AT H. B. ROBINSON UNIT NO. 2. Morgan, R. E. (Carolina Power and Light Co., Hartsville, SC). Trans. Am. Nucl. Soc.; 21: 442-443 (Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13087 BABCOCK AND WILCOX CHEMONUCLEAR ENGINEERING ASSISTANCE PROGRAM. Gurley, R. N. (Babcock and Wilcox Co., Lynchburg, VA); Uhl, D. L.; Hallman, D. F.; Maddox, J. D. Trans. Am. Nucl. Soc.; 21: 444(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13088 ANALYSIS OF CRITICAL EXPERIMENTS CONTAINING GADOLINIUM-POISONED FUEL. Henderson, W. B. (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc.; 21: 457-459(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13089 VERIFICATION OF A THREE-DIMENSIONAL DIFFUSION THEORY REACTOR MODEL FOR PWR ANALYSIS. Lucoff, D. M. (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc.; 21: 471-472(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13090 EVALUATION OF CORE PHYSICS ASPECTS OF COMBUSTION ENGINEERING REACTOR PERFORMANCE. Stuart, M. R.; Gavin, P. H. (Combustion Engineering, Inc., Windsor, CT). Trans. Am. Nucl. Soc.; 21: 472(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting: New Orleans, LA (8 Jun 1975).

13091 ANALYSIS OF END-OF-CYCLE CORE PHYSICS MEASUREMENTS SIMULATING A STEAMLINE BREAK. Dabby, D.; Rutgers, E. (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc.; 21: 472-473(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13092 ANALYSIS OF CORE PERFORMANCE AT THE OCONEE NUCLEAR POWER STATION. Woods, J. J. (Babcock and Wilcox Co., Apollo, PA); Sample, W. M. Trans. Am. Nucl. Soc.; 21: 483(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13093 IN-CYCLE MEASUREMENTS OF PHYSICS PARAMETERS IN PWRs. Bronner, G.; Krebs, W. D. (Kraftwerk Union AG, Erlangen, Ger.). Trans. Am. Nucl. Soc.; 21: 483-484(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13094 LOAD FOLLOW TESTS: INDIAN POINT UNIT NO. 2. Ginsberg, A. P. (Westinghouse Electric Corp., Pittsburgh); Imai, M.; Sipush, P. J. Trans. Am. Nucl. Soc.; 21: 484-485 (Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13095 OCONEE I RADIATION SURVEY. Hallman, D. F.; Chulick, E. T. (Babcock and Wilcox Co., Lynchburg, VA). Trans. Am. Nucl. Soc.; 21: 537-538(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13096 FUEL DENSIFICATION EXPERIENCE IN WESTINGHOUSE PRESSURIZED WATER REACTORS. Ferrari, H. M.; Roberts, E.; Scott, J. (Westinghouse Electric Corp., Pittsburgh). pp 54.1-54.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).
From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.
Although fuel densification under irradiation has probably occurred in most oxide fuel irradiated to date, the significance of this phenomenon became apparent only after the fuel densification and collapse observations in Beznau I and Ginna. Based on intensive evaluation of irradiated fuel fabricated by different processes to different specifications, many aspects of the fuel densification phenomenon are now becoming clear. Densification results primarily from the disappearance of fine porosity. It occurs rapidly and is essentially complete within a few thousand hours. Fuel densification is highly dependent on initial fuel fabrication processes and pellet microstructure. The phenomenon can be minimized by proper control of pellet microstructure. Clad flattening as occurred in early unpressurized fuel designs such as Beznau and Ginna can be avoided by increasing the initial helium pre-pressurization levels. All operating Westinghouse fuel after mid-1973 will be pre-pressurized. (14 references) (auth)

13097 IRRADIATION BEHAVIOR OF UO_2 AT BURNUPS FROM 10 TO 80 GWd/TONNE U. Baroch, C. J.; Rigdon, M. A. (Babcock and Wilcox, Lynchburg, VA). pp 58.1-58.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).
From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.
The fuel rods in a Babcock & Wilcox PWR are designed for a peak burnup of 55 GWd/tonne U during their three years of operation. The irradiation-induced swelling of the UO_2 in B&W's design is based on swelling data for plate-type UO_2 assuming that swelling rates observed in UO_2 wafers are applicable to cylindrical fuel rods. In 1967 B&W began a high-burnup program to determine the swelling rate of UO_2 as a function of burnup; the fuel rod designs were similar to those used by B&W. Other variables included in the program that may affect the swelling behavior of the fuel rods were heat rate, smeared density, cladding restraint, and fuel form. A description of the program and the results are presented. (5 references) (auth)

13098 BABCOCK AND WILCOX'S IRRADIATION PROGRAM ON FUEL DENSIFICATION. Rigdon, M. A.; Papazoglou, T. P.; Baroch, C. J.; Montgomery, M. H. (Babcock and Wilcox, Lynchburg, VA). pp 59.1-59.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).
From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.
Babcock & Wilcox is conducting a two-phase research program to investigate the fuel densification phenomenon. The effects of accumulated burnup, compressive stress, and fuel temperature on the densification of commercially produced UO_2 fuel pellets operating at linear heat rates from 3 to 5 kW/ft (98 to 165 W/cm) are being investigated in Phase 1. The effects of accumulated burnup, linear heat rate, and pore size distribution on the densification of specially manufactured UO_2 pellets with carefully controlled microstructures will be investigated during Phase 2. Four commercial fuels have been irradiated up to 1600 hours at linear heat rates ranging from 3.5 to 4.5 kW/ft (115 to 150 W/cm). The surface temperatures of these fuels are estimated to range from 700 to 800 F (370 to 420 C). Measurements taken from neutron radiographs indicate that no fuel columns have experienced shortening under these conditions. (5 references) (auth)

13099 FUEL ROD PERFORMANCE DURING A LOSS-OF-COOLANT ACCIDENT IN WESTINGHOUSE PRESSURIZED WATER REACTORS. Caso, C. L.; Gallagher, J.; Plumier, M. M. J. (Westinghouse Electric Co., Pittsburgh). pp 84.1-84.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).
From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.
The most probable and the required conservative design predictions of the fuel elements thermal transient in the event of a postulated loss of coolant accident are presented. The com-

parison of these calculations shows that the peak clad temperature for the most probable situation is approximately 1000°F lower than the clad temperature predicted by the design evaluation model. (auth)

13100 PWR FUEL RELIABILITY AND QUALITY ASSURANCE KWU EXPERIENCE. Knoedler, D.; Stehle, H. (Kraftwerkunion AG, Erlangen, Ger.). pp 87.1-87.5 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

The KWU PWR fuel experience of about 14 reactor years in several power stations together with results from irradiation experiments proved the value of an integrated quality assurance approach. Examples for the interdependence of fuel performance and various quality measures in design, manufacturing and laboratory activities are explained in the light of findings of core evaluation and PIE programs. (11 references) (auth)

Power Reactors, Non-Breeding, Graphite Moderated

Refer also to abstracts 13024, 13046, 13252, 13438, 13444, 13479, 13480, 13570, 13571, and 13652.

13101 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTOR BOILER SYSTEMS. Charcharos, A. N. (to British Nuclear Design and Construction Ltd.). British Patent 1,382,423/B/. 29 Jan 1975. Filed date 25 Feb 1971. 5p.

A reactor system is described which has one or more boiler systems each with an evaporator section and circulator means arranged to drive reactor coolant downwards through the reactor core. The system is arranged so as to receive at its lower end coolant leaving the reactor core and return such coolant to the circulator. The water inlet and steam of the evaporator sections are located at the lower and upper ends of the evaporator section, respectively, and the boiler system includes ducts arranged to guide coolant received from the reactor core downwardly through the evaporator sections. The evaporator sections are preferably annular, and it is preferable that the boiler system should have an annular economizer section located below the evaporator section with its upper end connected to the water inlet thereof, and an annular superheater section located above the evaporator section, with its lower end connected to the steam outlet. A coolant outlet duct then extends downwards through the superheater, evaporator and economizer sections. The boiler sections may be supported on brackets carried by a vertical cylindrical spine which passes through some or all of the sections. (UK)

13102 BINARY CYCLES FOR A HIGH TEMPERATURE GAS COOLED REACTOR WITH HELIUM TURBINE. Markoczy, G. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen, Switzerland). Ann. Nucl. Sci. Eng.; 1: No. 11/12, 555-559(Nov 1974).

The heat rejection of power plants to the environment can be reduced by using a binary (bottoming) power cycle which receives its energy input from the primary cycle cooler. High temperature gas cooled reactors with helium turbines are particularly favorable for binary cycle application due to their relatively high heat rejection temperatures and wide temperature range. The feasibility of such cycles was investigated for several working fluids. Their thermodynamic characteristics and estimated efficiency were compared. The results indicate that overall plant efficiencies of 49% are attainable with hydrocarbons and 47% with fluorocarbons (Freons) as working media. The incremental specific costs of the binary system would be substantially less than the cost of current nuclear plants. (auth)

13103 PRODUCTION OF HYDROCARBON POWER SOURCES BY HIGH TEMPERATURE FROM NUCLEAR REACTORS. Foldiak, G. (Budapest Izotop Intezete). Radioisotopy.; 16: No. 2, 175-180(Apr 1975). (In Czech).

The production of gaseous hydrocarbons as fuel power sources by means of high temperature nuclear reactors is described. It is shown that with respect to the increasing energy crisis and rising prices of energy sources, the production of gaseous hydrocarbons (e.g., synthetic rock gas type) in reactor heated generators is economically feasible and promising. (auth)

13104 VERY HIGH TEMPERATURE HEAT-GENERATOR. Martin, R.; Maillet, E.; Pierre, B. (to CEA). French Patent 2,211,716/A/. 27 Dec 1972. 10p. (In French).

The invention relates to a heat-generator adapted to provide very high temperatures, in particular above 1000°C. The generator comprises a nuclear reactor, at least one heat-exchanger and primary and secondary cooling fluids formed of a powder dispersed in an inert gas. The generator can be used in particular, for providing heat in thermo-chemistry. (FR)

13105 HELIUM USAGE IN LARGE GAS-COOLED REACTORS. Kuzmycz, G. (Gilbert Associates, Inc., Washington, DC). Cryog. Ind. Gases; 9: No. 4, 15-20(1974).

The development of gas-cooled reactors is reviewed. Design characteristics of high-temperature helium-cooled power reactors are presented. 14 references. (DCC)

13106 SYMPOSIUM ON HIGH TEMPERATURE GAS COOLED REACTORS. Atoomenerg. Haar Toepass.; 17: No. 4, 92-97(Apr 1975). (In Dutch).

Discussions are summarized following speeches by representatives of the Dragon project, RCN, Petten, and General Atomics International. Topics included: coated particles, fission product cycles, gas turbines, process heating, and a hierarchical chart of development possibilities. Safety aspects were considered from the standpoint of inherent safety, both of the graphite core and helium coolant, and the safety aspects of auxiliary items such as the auxiliary cooling system, fission products etc. A parameter list is given of major features of gas cooled fast reactors, both a 300 MW(e) demonstration unit and a 1200 MW(e) power reactor, both of which use helium coolant at 85 bars pressure and employ a thoria breeder zone. (NL)

13107 HISTORY OF COATED PARTICLES. Scott, J. L. (Oak Ridge National Lab., TN). Trans. Am. Nucl. Soc.; 21: 170-171(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13108 HISTORY OF HTGR FUEL ELEMENT DEVELOPMENT AT GENERAL ATOMIC. Simnad, M. (General Atomic Co., San Diego, CA). Trans. Am. Nucl. Soc.; 21: 171-173(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13109 IODINE ADSORPTION ON HTGR COOLANT CIRCUIT MATERIALS. Osborne, M. F. (Oak Ridge National Lab., TN); Compere, E. L.; de Nordwall, H. J. Trans. Am. Nucl. Soc.; 21: 330(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13110 MOISTURE DETECTOR FOR THE PRIMARY LOOP OF GAS-COOLED REACTORS. Dowdy, E. J.; Taylor, G. W. (Los Alamos Scientific Lab., NM). Trans. Am. Nucl. Soc.; 21: 331 (Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13111 EFFECTS OF HELIUM MIXING WITH HEAT TRANSFER ON CONTAINMENT DESIGN PRESSURE IN AN HTGR. McCarty, J. R.; Kolar, M. J. (Commonwealth Associates, Inc., Jackson, MI). Trans. Am. Nucl. Soc.; 21: 331-332(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13112 PREDICTION OF CACS AVAILABILITY AND RELIABILITY. Solomon, K. A. (Univ. of California, Los Angeles); Okrent, D.; Kastenberg, W. E. Trans. Am. Nucl. Soc.; 21: 332 (Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13113 STARTUP PHYSICS TESTS AT FORT ST. VRAIN. Ross, S. R. (Public Service Co. of Colorado, Denver); Brown, J. R.; Nirschl, R. J. Trans. Am. Nucl. Soc.; 21: 485(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13114 OPERATIONAL EXPERIENCE WITH NUCLEAR FUEL IN CEGB REACTORS. Mummery, G. B.; Hines, G. F. (Central Electric Generating Board, Berkeley, Eng.). pp 1.1-1.5 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

Ways in which operation of the CEGB MkI (Magnox) reactors have been affected by fuel element performance are discussed. The topics covered include the occurrence and detection of fuel element failures, loss of insulation resistance on thermocouple fuel elements and the observation of a few cases of high discharge forces. The operators' criteria for judging fuel performance are discussed and the overall performance of the fuel is shown to be most satisfactory. (9 references) (auth)

13115 PERFORMANCE OF THE TUBULAR FUEL ELEMENTS OF THE FRENCH NATURAL URANIUM, GRAPHITE MODERATED GAS-COOLED REACTORS. Boudouresques, B. (CEA, Saclay, France); Ollier, H.; Garaud, J.; Bournay, P. pp 2.1-2.5 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

There are six natural uranium/graphite/gas reactors in France. The performance of two types of elements is discussed: elements in which the fuel is a tube of a uranium-molybdenum (1.1%) alloy, of length 540 mm with internal and external diameters 18 and 40 mm or 23 and 43 mm; and elements in which the fuel is a tube of "Sicral F1" alloy (U−0.07% Al−0.03% Fe−0.01% Si−0.01% Cr), 540 mm long with inner and outer diameters 23 and 43 mm with a graphite core. (auth)

13116 PERFORMANCE OF URANIUM/MAGNOX FUEL ELEMENTS IN THE UK REACTOR. Eldred, V. W. (UKAEA, Windscale, Eng.); Harris, J. E.; Shaw, R. A. pp 3.1-3.5 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

The performance of the Magnox fuel element has been studied during a comprehensive post-irradiation examination programme carried out during the past fifteen years. A number of the problems encountered are described and the present highly satisfactory performance of the element is emphasized. The fuel element failure rate is currently at a low level and deformation of the fins by an oxide stretching process is no longer a cause for concern. The channel average discharge irradiation at many stations has recently been increased to 4,000 MWD/te and as new knowledge on performance is accumulated further steps will be taken to close the gap between the metallurgical and reactivity limit of the fuel. (18 references) (auth)

13117 EXPERIENCE ON THE HOLLOW ROD FUEL IN THE TOKAI, REACTOR. Imai, R.; Kuge, Y.; Ikeda, T. (Japan Atomic Power, Co., Tokyo). pp 4.1-4.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

The experience on fuel irradiation in the Tokai reactor is described. The experience with this fuel over the past six years shows satisfactory performance. (auth)

13118 DEVELOPMENT OF HERRINGBONE FUEL ELEMENTS AND INTRODUCTION INTO THE UK MAGNOX REACTORS. Chamberlain, A. (BNFL, Springfields, Eng.); Slack, M. R. pp 5.1-5.6 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

The introduction of the herringbone fuel element into the UK Mark I Gas Cooled Reactors is described. The supporting development work is reviewed under the following headings: thermal performance; stability; endurance; manufacture; and irradiation. The experience to date and the progress made towards improvement are discussed. (6 references) (auth)

13119 REVIEW OF QUALITY ASSURANCE ON THE MANUFACTURING OF FUEL IN THE UK. Heal, T. J.; Archer, L. G. (BNFL, Springfield, Eng.). pp 6.1-6.3 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

Quality assurance is described or embracing the practices such as feed materials control, process control, product quality control and product quality audit. The inter-related working ensures the very high quality of nuclear fuel produced by BNFL (previously the United Kingdom Atomic Energy Authority) at the Company's Springfields Works. (auth)

13120 MECHANICAL PROPERTIES OF AGR CLADDING. Winton, J. (UKAEA, Springfields, Eng.); Rhodes, D.; Jones, R. B.; Roberts, A. C.; Haberlin, M. M.; Waddington, J. S. pp 7.1-7.5 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

The cladding alloy for the first charges of the Civil Advanced Gas Cooled Reactor is to be a stabilized stainless steel containing 20% Cr, 25% Ni and typically about 0.04% C and 0.5% Nb. The fuel tubes to be made from this alloy will be 1.458 cm i.d. and 0.037 cm wall thickness. During reactor operation the fuel tubes will be at temperatures in the range 350 to 825°C and will be externally pressurized by the CO_2/CO coolant. The amount of strain that the clad can accommodate before failure is a complex function of the mechanical properties. The input for computer programs for assessing endurance requires data from tube rupture, tensile, creep and fatigue tests and the effect of irradiation on these properties. These data are summarized after reviewing the way in which the fuel pin production route was developed to achieve the required properties. (15 references) (auth)

13121 OXIDATION OF AGR CLADDING. Cowen, H. C. (UKAEA, Risley, Eng.); Webster, S. J. pp 8.1-8.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

The oxidation characteristics of 20% Cr/25% Ni/Nb-stabilized stainless steel in CO_2-based atmospheres are reviewed in relation to the endurance of AGR fuel elements. The large volume of data now available demonstrates that a small margin of temperature exists over the 825°C selected some years ago as peak can temperature. (9 references) (auth)

13122 METALLOGRAPHIC ASSESSMENT OF SOME ASPECTS OF WAGR FUEL PERFORMANCE. Skinner, J.; Newbigging, A. W. P. (UKAEA, Windscale, Eng.). pp 9.1-9.5 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

The contributions made by optical microscopy and associated techniques to the understanding of four aspects of WAGR fuel pin performance are described. These are the compatibility of cladding and coolant, structural changes that occur in 20/25 Nb cladding as a result of irradiation at operating temperatures, the investigation of failure mechanisms and mechanical interaction effects between fuel and cladding under operating conditions, and finally the compatibility of fuel and cladding. The value of metallographic examination is illustrated by specific examples of fuel pin failures resulting from quite different causes, which have been identified. (7 references) (auth)

13123 DIMENSIONAL CHANGES IN WAGR FUEL PINS. Skinner, J. (UKAEA, Windscale, Eng.); Bradshaw, K. A.; Stacey, R. D. pp 10.1-10.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

The dimensional changes that occur in WAGR fuel pins during irradiation have been studied over a period of ten years on a variety of pin designs. The factors that affect the magnitude of the dimensional changes are described, and typical results obtained with WAGR pins are reported. (11 references) (auth)

13124 WINDSCALE ADVANCED GAS-COOLED REACTOR (WAGR) FUEL PIN OPERATING EXPERIENCE. Evans, D. M.; Gallie, R. R.; Thorpe, G. (UKAEA, Windscale, Eng.). pp 11.1-11.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

The irradiation programme in fuel pin development in the Windscale Advanced Gas-Cooled Reactor is described, covering all aspects of commercial reactor behavior, both in the steady state, and in various likely power cycling modes. The results to date give confidence that the current design of fuel pin will meet base load operating conditions, and encouragement that the power cycling capability of the fuel will be demonstrated at the operating conditions of commercial reactors. (4 references) (auth)

13125 ROLE OF MECHANICAL ENGINEERING IN COMMERCIAL AGR FUEL STRINGER DEVELOPMENT. Jones, C. H. (UKAEA, Springfields, Eng.); Stacey, R. D.; Stubbs, J. J. pp 12.1-12.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

The evolution is presented of a typical reference design of AGR fuel stringer for manufacture and use in a commercial AGR nuclear power station from the initial proof design which exists at the time the station contract is awarded. An outline is given of a typical broad based development programme to demonstrate the adequacy of the basic design features for the envisaged in-reactor service conditions with emphasis on the mechanical and dynamical aspects of the work. Both small-scale bench testing and large scale engineering test facilities

are utilized. Although the fuel element is almost identical for each of the various designs of reactor under construction, the complete fuel stringer is associated with different plug units and core designs. This causes the fuel stringers for these stations to respond dynamically in different ways. The use of large engineering test rigs is indicated by a review of experiments in the pressurized CO_2 loop, SCOT, to study the dynamic response of full size stringers and components to the various flows and acoustic excitation. (auth)

13126 METHODS OF INSPECTION AND TESTING OF HTR FUELS. Holliday, J.; Price, M. S. T.; Siddall, R. E. pp 13.1-13.10 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

The emergence of coated particle fuel for use in the High Temperature Gas-Cooled Reactor has been aided by the continuous development of inspection and testing methods. Coated particle fuel bodies are fabricated in a sequence of operations all of which can affect the performance of the fuel. Inspection and testing are therefore carried out as part of an overall scheme of Quality Management. The methods and economics of testing fuel kernels, coatings, fuel bodies and structural graphite are reviewed. Although the design of HTR fuel is relatively complex, the large population of coated particles in a reactor (typically in excess of 10^{10}) simplifies the application of statistical methods. It is vital to support the testing service with efficient data processing. The system developed by the Dragon Project for data processing and preliminary analysis to assist quality management is described. (21 references) (auth)

13127 QUALITY MANAGEMENT FOR HTR FUELS. Audebeau, J. P.; Lefevre, R. L. R.; Price, M. S. T. pp 14.1-14.10 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

The concept of Quality Management is applicable to any product. The complex nature of HTR fuel renders it imperative that quality is built into the product and not to rely solely on post-manufacture controls. The Dragon Project is in the fortunate position of being both customer and supplier as well as being in close contact with the world wide effort on HTR fuel. A detailed scheme of quality management for HTR fuels is developed and examples of its application are given. The more extensive application of these techniques will result in an optimum quality specification. (31 references) (auth)

13128 QUALITY ASSURANCE IN THE UNITED KINGDOM ON HTR FUEL. Harper, J. (UKAEA, Springfields, Eng.); Heal, T. J. pp 15.1-15.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

Fabrication development studies for HTR fuel undertaken at the Reactor Group Fuel Element Laboratories of the UKAEA and at BNFL are aimed at defining an economic manufacturing route by which fuel of the specified quality can be produced at the rate required for fuelling a substantial programme of civil stations. During development of the manufacturing route considerable emphasis has been placed on minimizing manufacturing costs and the testing of the stages devised under realistic manufacturing conditions. (auth)

13129 QUALITY ASSURANCE ASPECTS OF THE FORT ST. VRAIN FUEL. Hoffman, B. L.; Scarborough, J. C. (NUS Corp., Washington, DC). pp 15A.15A.6 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

Some aspects of the FSV Core 1 production experience are reviewed within the context of PSC's Fuel Quality Assurance Program. It is thus oriented more towards the purchaser organization's interests as regards fuel product integrity than that of the supplier's. Unlike typical nuclear fuel commercial arrangements, GGA will own the FSV fuel for an eight year period (initial core and six reload segments) and be reimbursed for energy extracted from the core under an existing Fuel Agreement between PSC and GGA. Nevertheless, incentives to PSC for quality fuel product exist other than those imposed by regulatory statute—economic penalties from possible fuel-related unscheduled outages accrue to PSC as the utility Station owner-operator. (8 references) (auth)

13130 FISSION PRODUCT RETENTION CHARACTERISTICS OF HTGR FUEL. Burnette, R. D.; Bell, W. E.; Baldwin, N. L. (Gulf General Atomic, San Diego, CA). pp 16.1-16.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

High-Temperature Gas-Cooled Reactor (HTGR) fuel consists of particles of dense uranium and thorium oxide or carbide overcoated with pyrolytic carbon and, in some cases, silicon carbide. The fission product retention characteristics of the coated particles depend on the fission product species involved, the type and integrity of the coating, burnup, neutron fluence, and temperature. The nonvolatile metals (Y, Ru, Zr) are immobile at HTGR operating temperature and remain with the fuel. The fission gases (Xe, Kr, I) are satisfactorily retained by particle coatings, and release of the gases is from particles with failed coatings or from fuel contamination. The volatile metals (Sr, Cs, Ba) have appreciable diffusivities in pyrolytic carbon. Data are presented on (1) the fission gas release behavior of particles with failed coatings, (2) the relationship between gas release and fuel contamination, and (3) release behavior of the volatile metals from particles coated with pyrolytic carbon. (auth)

13131 PREDICTION OF FISSION PRODUCT BEHAVIOR IN HTR's. Nastri, G.; Rowland, P. R.; Shepherd, J. pp 17.1-17.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

Fission products of importance in HTR's can be classified broadly into three categories according to their characteristic behavior patterns. There are a number of known barriers to fission product escape from HTR systems and the relative importance of these barriers for each of the three categories is discussed. Several mathematical models for calculating the release rates of the different types of fission products have been developed. The basic data required for use in these models has been obtained from laboratory work, from in-pile loop experiments and from post-irradiation examination of experimental HTR fuels of different types. The various methods have been applied to individual fuel elements in the Dragon Reactor and to the Reactor as a whole, using the best currently available data. The results of such calculations are compared with experimental measurements of fission products on the Dragon system. Methods of improving the models are discussed and the extra data that will then be necessary to make full use of the improved models is high-lighted. Desirable further experimental and theoretical work thus identified is discussed. (24 references) (auth)

13132 INTERIM REPORT ON FISSION-PRODUCT RELEASE DURING OPERATION OF THE SECOND PEACH BOTTOM CORE. De Nordwall, H. J.; Kolb, J. O.; Dyer, F. F.; Martin, W. J. (Oak Ridge National Lab., TN). pp 18.1-18.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

The results of experiments that describe the releases and distribution of rare gases, iodine, cesium and other fission products during the operation of the second Peach Bottom HTGR Core are presented. (auth)

13133 INTERACTION BETWEEN SILICON CARBIDE, CAESIUM AND STRONTIUM. Coen, V.; Erben, E.; Quataert, D. (EURATOM-CCR, Ispra, Italy). pp 19.1-19.5 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

Highly dense, crack free, polycrystalline β silicon carbide discs have been prepared by vapor phase deposition techniques using trichlormethylsilane-hydrogen mixtures. Selected samples have been heat treated at high temperature under a defined vapor pressure of metallic Cs and Sr in a specially designed device. The distribution of the metal in the silicon carbide has been examined with the ion analyzer and with the scanning electron microscope. A pitting corrosion effect has been evidenced. (9 references) (auth)

13134 BEHAVIOR OF SILICON CARBIDE COATINGS IN THE HTR. Voice, E. H.; Walther, H.; York, J. pp 20.1-20.8 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

The migration of fission products through the polycrystalline silicon carbide coatings of HTR fuel particles has been studied in laboratory experiments and the release coefficients related to the silicon carbide formation conditions. The "optimum" material is entirely satisfactory as the principal fission product

barrier for first-generation power HTR's. In reactor service at very high temperature, on the other hand, the release of an unexpected isotope, Ag-110m, often predominates, and possible reasons for this are considered. (8 references) (auth)

13135 CONSIDERATION OF THE FISSION PRODUCT RELEASE FROM HTGR-CORES. Roellig, K. (HRB, Mannheim, Ger.); Rotterdam, R.; Mielken, G. pp 21.1-21.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

The release of the noble gases was measured in a series of irradiation experiments yielding a linear relation between gas release and the fraction of uncoated fuel. At mean fuel-temperatures of 800°C, about 99% of the Kr-88 produced by the initial heavy metal contamination is retained within the fuel element due to the recoil delay in the matrix material. The fractional release of I-131 is about equal to that of Xe-133 in a wide range of experimental conditions. The release of Cs-137 is determined not only by uncoated fuel but also by the retention properties of the intact pyrocarbon (PyC) coated particles. In the case of the U, Th-fuel cycle with silicon carbide (SiC) coated feed and PyC-coated breed particles, the release contribution of both fuel types depends strongly on the thermal conditions in the core and the particle design. Calculations demonstrate the different requirements for the particle layout for both prismatic and spherical fuel elements. Further calculations are presented investigating the influence of the cesium partial-pressure in the coolant on the release from the fuel element. This usually neglected interaction reduces the Cs-137-release from a core with spherical fuel elements by about 50%. (auth)

13136 BEHAVIOR OF SOLID FISSION PRODUCTS IN THE AVR PEBBLE-BED REACTOR. Engelhard, J.; Mehrens, H.; Gottaut, H.; Muenchow, K. H.; Nieder, R. (Kernforschungsanlage, Juelich, Ger.). pp 22.1-22.5 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

In the AVR plant, the first high temperature reactor with spherical fuel elements, the concentrations of non-gaseous radioactive fission products in the He coolant have been measured by putting new experimental devices into operation. The results of the first experiments and tests are reported. The activity concentrations measured as well as the R/B values computed on the basis of these measurements show the very good retention of the fuel elements regarding to the most important fission products such as iodine and cesium. The I 131 quantity existing under equilibrium conditions in the coolant and on the core surfaces is estimated on the basis of concentration measurements of the decay product Xe 131m in the AVR coolant gas. (auth)

13137 BEHAVIOR OF SOLID FISSION PRODUCTS IN THE AVR PEBBLE-BED REACTOR. Addendum to Paper 22. Engelhard, J.; Mehrens, H.; Gottaut, H.; Muenchow, K. H.; Nieder, R. (Kernforschungsanlage, Juelich, Ger.). pp 22.5 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

One further VAMPYR experiment and two dust filter tests have been carried out and evaluated. During one VAMPYR- and dust filter-test, the mean hot gas temperature of the reactor was 770°C; this means the temperature was about 80°C lower than during the other experiments. The concentrations of non gaseous fission- and activation-products in the hot and cold part of the primary circuit calculated from these experiments are listed. (auth)

13138 FISSION PRODUCT CONTROL IN THE HTR. Flowers, R. H. (Atomic Energy Research Establishment, Harwell, Eng.). pp 23.1-23.6 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

The transport behavior of a number of key fission products is described in a semi-quantitative manner and then evaluated in terms of some realistic radiological criteria concerning core releases. The broad implications on coated particle specification are stated. Attention is drawn to future developments in fission product control in HTR fuels. (7 references) (auth)

13139 IRRADIATION BEHAVIOR OF HTR GRAPHITES. Everett, M. R.; Blackstone, R.; Krefeld, R.; Delle, W. W. pp 24.1-24.5 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

The irradiation induced property changes of graphites based on Gilsocarbon coke, pitch coke and petroleum coke are surveyed and contrasted. Examples are given of dimensional behavior, changes in Young's Modulus, coefficient of thermal expansion. Data on many graphites is now available at fast neutron fluences much in excess of normal service requirements for fuel elements and reflector blocks for both thorium and low enriched uranium cycle reactors. The data cover a temperature range from 400 to 1400°C thus simplifying the problems of interpolation and extrapolation met in the preparation of systematized data for use in design assessment studies. The suitability of graphites from the present range of commercial products is assessed in terms relative to service requirements. Experience gained from the post-irradiation examination of fuel elements and reflector blocks irradiated in the Dragon Reactor illustrates the excellent performance record of graphite in the HTR. The potentiality of some graphites which are in course of development is outlined. (9 references) (auth)

13140 PROPERTIES AND IRRADIATION BEHAVIOR OF A GRAPHITE FOR HTR FUEL ELEMENTS. Mottet, P. S. L. (CEA, Saclay, France); Rappeneau, J. P.; Lore, J. G. A.; Cornuault, P. P. pp 25.1-25.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance, London, UK (15 Oct 1973). See CONF-731004-.

Graphites produced by the extrusion of pitch coke have shown themselves to be of particular interest and they are being developed industrially under the reference P_3JHAN and P_3JHA_2N. The manufacture and properties of these graphites are described. (auth)

13141 PROGRESS IN GRAPHITE AND MARTIX DEVELOPMENT WORK FOR HTGR IN THE FEDERAL REPUBLIC OF GERMANY. Delle, W. W. (Kernforschungsanlage, Juelich, Ger.); Huschka, H.; Leushacke, D. F.; Rosswurm, H.; Theymann, W. pp 27.1-27.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

The report summarizes the present status and programme in the development and accompanying basic studies of graphite and matrix materials for power scale HTGR in Germany. The main points of the work are development, production and testing under irradiation of graphites and matrix materials for fuel elements and reflectors. The chemical and physical properties of these materials are discussed in terms of reactor physical and design specifications. Results of irradiation up to the core requirements are presented and the ability of these materials in HTGR is proved. (9 references) (auth)

13142 IRRADIATION BEHAVIOR OF HTR FUEL COMPACTS. Everett, M. R.; Blackstone, R. pp 29.1-29.5 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

The irradiation induced property changes of HTR fuel compacts are summarized. The mechanical properties, internal stress patterns and dimensional changes can be shown to be related to structural features associated with the volume loading of coated particles, the quantity of binder used in the graphite matrix and the individual dimensional changes of these component parts. The irradiation performance of pressed overcoated cylindrical compacts easily meets the requirements for multihole block low enriched high temperature power reactor designs. (5 references) (auth)

13143 REVIEW OF HTR GRAPHITE CORROSION. Ashworth, F. P. O.; Kinsey, D. V.; Wilkinson, V. pp 30.1-30.5 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

The current situation with regard to the possible problems of corrosion in High Temperature Reactor cores is described. The implication of the present state of data for reactor design and operation is considered and a brief account of corrosion in accident conditions is given. (14 references) (auth)

13144 COATED FUEL PARTICLES FOR HTGR, RESULTS AND FURTHER DEVELOPMENT IN THE FEDERAL REPUBLIC OF GERMANY. Baier, J. (Kernforschungsanlage, Juelich, Ger.); Mueller, H. B.; Mehner, A. W. (Kernforschungsanlage, Juelich, Ger.). pp 31.1-31.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

Coated particle fuel development for the AVR reactor and THTR-300 has been completed. Irradiation test results show

the performance and fission product retention of the particles specified to be satisfactory. Work on coated particle fuel for U-Th-feed-breed fuel cycle has started recently. The first encouraging test results and the future programme are being dealt with. (auth)

13145 COATED PARTICLE FUELS FOR THE LOW ENRICHED FUEL CYCLE HTR. Sayers, J. B. (Atomic Energy Research Establishment, Harwell, Eng.); Horsley, G. W.; Martin, D. G.; Rose, K. S. B.; Williams, J.; Sawbridge, P. T.; Horner, P.; Simpson, K. A. pp 32.1-32.6 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

An extensive development programme on coated particle fuels has been undertaken in the UK over the last three years. Irradiation experiments have been mounted using the MTR's at Harwell, DFR and the Dragon reactor to provide design data and to determine the limits of performance of the UK reference particle design for the Low Enriched Fuel Cycle HTR. The data obtained in relationship to the target conditions of temperature, burn up and fast neutron dose are presented. (9 references) (auth)

13146 BEHAVIOR OF PYROCARBON FUEL COATINGS AT HIGH FAST NEUTRON DOSE. Janvier, J. C.; Moreau, C.; Voice, E. H. (CEN, Saclay, France). pp 33.1-33.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004-.

In a study of HTR fuel particle performance as a function of the pyrocarbon source gas, realistic coated particles were irradiated in the RAPSODIE reactor at temperatures between 800°C and 1200°C to fast neutron doses above 6×10^{21} n/cm^{-2}DNE. Coatings from methane failed below 3×10^{21} n/cm^{-2} DNE, whereas coatings from propane and butane could survive to the highest doses when formed without internal inhomogeneities or structural gradients. (auth)

13147 FISSION GAS PRESSURE EVOLUTION IN IRRADIATED COATED PARTICLES. Janvier, J. C. (CEN, Grenoble, France); Bruet, M.; Blanchard, R. pp 34.1-34.5 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.

Stable and long-lived isotopes of fission gases present in the free volume of sound irradiated particles are currently collected and analyzed. The internally released fraction measured is shown to be essentially independant of temperature, but related to the burnup in the range 2 to 8% FIMA. On the other hand, the free volume of the irradiated particles has been measured. Those measurements show a corresponding increase in the free volume with irradiation. The value of the fission gases pressure obtained from direct measurements is compared with the figures calculated from the above result. 6 references. (auth)

13148 FUEL KERNEL MATERIALS FOR THE THORIUM CYCLE HTGR. Stansfield, O. M.; Gulden, T. D.; Harmon, D. P. (Gulf General Atomic, San Diego, CA). pp 35.1-35.5 of Nuclear Fuel Performance. London; British Nuclear Energy Soceity (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.

The thorium cycle HTGR typically employs fissile particles containing fully enriched uranium and fertile particles containing thorium. Small fuel kernels (~10^{-5} cm^3 in volume) are separated by coating layers and matrix material so that the mechanical and thermal properties of the fuel body are to a large extent independent of the fuel kernel properties. This feature gives rise to an advantageous flexibility in kernel selection. Both dioxide and dicarbide kernels of Th and U and solutions of the two have been developed. During irradiation carbide and oxide kernels undergo swelling and accumulate a significant fission product inventory. Interaction between the kernel and outer structural coatings is prevented by an intervening low density buffer layer. Kernel migration into the coating up the thermal gradient is exhibited by both carbide and oxides. A limitation of coating penetration due to kernel migration in carbide fuels forms the basis for core thermal design. Thorium oxide is the most stable kernel material with little propensity for migration relative to other oxides and the carbides. Mixed oxide fuels have been favored in European HTR design. In the United States where a segregated thorium cycle is employed, fissile UC_2 and fertile ThO_2 kernels have been selected for HTGR fuel based on optimization of performance and predictability under operating conditions. 12 references. (auth)

13149 SIGNIFICANCE OF GAS-PRESSURE BUILD-UP IN COATED PARTICLES. Wagner-Loeffler, M.; Hick, H.; Nabielek, H.; Steemers, T.; Bildstein, H.; Muellner, P.; Strigl, A. pp 36.1-36.8 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.

A summary of knowledge on gas-pressure build-up in UO_2 coated particle fuel is presented. The free volume available for the accommodation of fission gases (Kr, Xe) and CO in individual coated particles has been measured by a volume sharing technique and the results are in reasonable agreement with calculated free volumes based on coated particle pre-irradiation data. The gas content of individual particles has also been measured by a mass-spectrometer upon hot crushing for a large variety of particle types and operating conditions. Internal fission gas release from the kernel can be described by a function of kernel irradiation temperature and time or total burnup, while the free oxygen release depends also on the chemical composition and deviations from chemical equilibrium. Total gas pressures can be calculated with the Redlich-Kwong equation from the data mentioned above and these can also be checked by direct experimental determination. Knowledge of gas pressure build-up is generally of considerable importance but also specifically for the interpretation of post-irradiation bursting experiments which can be considered to be a very relevant test of fuel performance prediction models. 34 references. (auth)

13150 TESTING AND IRRADIATION PERFORMANCE OF COATED PARTICLE FUELS FOR HTGR'S. Coobs, J.; Eatherly, W. P.; Scott, J. L. (Oak Ridge National Lab., TN). pp 38.1-38.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.

Fuel for large HTGR power stations in the United States consists of coated particles of ThO_2 as fertile material mixed with smaller coated particles containing fissile material, either ^{233}U from recycle of bred fuel or ^{235}U as makeup fuel. A series of nine batches of coated ThO_2 particles with various coating designs were prepared and tested to fluences exceeding the design HTGR fluence. The good performance of some batches was consistent with predictions based on a mechanical model. The use of weak-acid ion exchange resin particles as the fissile fuel kernel offers several advantages in processing and properties. Pilot-scale preparation and testing of resin-base fuels demonstrated that their performance is most encouraging and indicate that such fuels may be capable of operating at temperatures well above 1300°C. Such high-performance fuels are desirable for process heat and direct-cycle applications. 12 references. (auth)

13151 PERFORMANCE LIMITS OF COATED PARTICLE FUEL. Graham, L. W.; Hick, H. pp 39.1-39.9 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.

The task of coated particle fuel in an HTR fuel body is to produce power at high temperatures and yet to retain the fission products without producing any adverse effect on the integrity of the fuel body. The performance of coated particle fuel in these respects relies on its ability to sustain high internal pressures and fast neutron dose levels without mechanical fracture or significant dimensional changes, and the retention of fission products in a complex internal chemical environment. Pressure failure due to burnup is not seen as being seriously limiting. Excellent quantitative rationalisation of experimental data has been achieved. Fast neutron dose induced limits are defined for methane-derived PyC and results on alternative pyrocarbons indicate very significant improvements over these limits. Chemical processes within a coated particle are complicated because of the many possible reactants. However, only two important groups of phenomena have been seen so far, carbon transport (amoeba attack) and SiC deterioration (at very high temperatures). Generally chemical processes can have an adverse effect on mechanical performance as well as fission product retention. In the light of these effects, a review of experimental results, together with their theoretical and quantitative rationalisation to provide performance data, is given. Essentially, to provide this requires normalisation of data to reference designs and this also allows the existing experimental data to be used to describe the performance of particles with more advanced requirements. Finally, likely trends in coated particle developments for power reactors are briefly discussed. 12 references. (auth)

13152 IRRADIATION PERFORMANCE OF HTR FUEL PINS. Prince, K. (UKAEA, Risley, Eng.); Hartog, J. M. pp 40.1-40.7 of Nuclear Fuel Performance. London, British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.

A principle feature of the UKAEA development programme in support of the UK designs of HTR has been the development and proving of a reference design of fuel pin of the Tubular Interacting type. The irradiation performance of this type of fuel pin is reviewed using analytical assessments and also in the light of the results of fuel pin irradiation experiments carried out mainly in the Dragon reactor as part of the OECD Dragon Project programme. The major factors affecting the integrity and performance of the fuel pin are described and the current status of the concept is assessed against the duty it is required to meet in the power reactor. It is concluded that the results of the experiments coupled with the evidence afforded by component properties data promise excellent performance of the Tubular Interacting Pin concept. (auth)

13153 THERMAL AND MECHANICAL PERFORMANCE OF HTR FUEL ELEMENTS. Kinkead, A. N.; Barr, P.; Everett, M. R. pp 41.1-41.8 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.

Current methods of thermal and structural performance predictions are outlined in relation to a number of different fuel element concepts some of which have already been irradiated in the Dragon Reactor Experiment. Methods developed for correlation between predicted and measured residual post-irradiation strains in the graphite fuel enclosures are also described and an example of the application of these methods is given in the case of a specific fuel pin which has been removed from the reactor and examined in hot cell and glove-box. 16 references. (auth)

13154 MECHANICAL STRESSES IN PRESSED FUEL-BLOCKS DURING REACTOR OPERATION AND SHUT DOWN. Seeser, W. R. (HRB,Mannheim, Ger.); Theymann, W.; Cords, H.; Hrovat, M. pp 42.1-42.6 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.

A pressed prismatic fuel-element has been developed by NUKEM for a high power-density. Up to now the molding experiments have been successful, but the procedures and matrix development were the major points of work. After optimization of the element, the stresses and deformations were calculated for two different fuel arrangements in order to judge their technical potential. The calculations are based on the physical data of a 1160 MW(e) gas cooled high temperature reactor core. The temperatures and stresses of the fuel blocks are calculated for an operating time of 4 years at different times during reactor operation and shut down. Radiation induced shrinkage and creep behaviour of the matrix-material are regarded as well as the changes of material properties in accordance to the changes of temperature and fast neutron fluence. (auth)

13155 PERFORMANCE OF AVR FUEL ELEMENTS. Ivens, G.; Wimmers, M.; Ragoss, H. pp 43.1-43.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.

The particular advantages of realistic mass irradiation of spherical fuel elements in the AVR high temperature reactor are pointed out; moreover some results of post-irradiation examinations and information on the performance of the fuel elements in the reactor circuit are given. (auth)

13156 THERMAL AND NEUTRONIC PERFORMANCE OF PEBBLE BED FUEL ELEMENTS. Teuchert, E.; Maly, V. (Kernforschungsanlage, Juelich, Ger.). pp 44.1-44.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.

The fuel elements in the pebble bed reactor are either cyclically inserted or moved only once through the core. For both schemes the history of exposure to neutron flux and temperature is given which is basical for the analysis of the actual material behaviour. The dependency of the heat conductivity λ on the temperature and fast doses causes a retardation of the temperature gradients compared to the power production in the balls. In the once through system the effect of uncertainties in λ on the fuel temperature in the hot area is only 4°C due to the reduced power. The withdrawal of the control rods shifts the power maximum to the fresh balls at the top avoiding an appreciable increase in the temperature gradient. Unstable fission products are partly decayed when the balls reach the hot area at the bottom. 4 references. (auth)

13157 HTR FUEL ELEMENT IRRADIATIONS. Ballagny, A.; Loriers, H.; Ringot, C. (CEA, Saclay, France). pp 45.1-45.6 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.

The French programme of HTR fuel development was first linked with the tubular interacting fuel pin concept. The fuel was manufactured in France according to the Dragon Project's basic technology. An anisotropic fine-grained extruded graphite was selected for the fuel tubes. Several fuel element irradiations have been achieved in the test reactors Osiris and Pegase, and in the Dragon Reactor Experiment. No failure has been observed with the reference fuel up to 3.2×10^{21} n/cm^2 DIDO Ni equivalent (DNE) under nominal conditions. In addition the fuel element has proven to sustain successfully severe accident conditions. The programme was reoriented in 1972 to the integral block concept and a new series of tests is now under way. (auth)

13158 IRRADIATION EXPERIENCE WITH TUBULAR INTERACTING PINS FOR HIGH TEMPERATURE REACTORS. Gaube, M.; Bairiot, H. (Belgonucleaire, Brussels). pp 46.1-46.8 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.

The adoption, in 1970, of the tubular interacting fuel pin as the reference design for the High Temperature Reactor program in Europe, was followed by the decision to mount three irradiation experiments in the DRAGON reactor. These experiments were designed to simulate as closely as possible the operating conditions of the reference fuel, to study the pin behaviour in some particular circumstances, to investigate the importance of some basic parameters and to demonstrate the ability of industry to design and fabricate HTR fuel. Results of these experiments are presented. (auth)

13159 UO_2 FUEL PERFORMANCE MODELLING AND PREDICTIVE METHODS. Collins, D. A.; Hargreaves, R.; Hughes, H. (UKAEA, Windscale, Eng.). pp 49.1-49.5 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.

Computer codes that predict fuel pin performance are required for fuel pin design, reactor safety assessment and economic fuel management. Knowledge gained from the study of performance-limiting phenomena in irradiated UO_2 has been used to develop models enabling quantitative prediction of fuel behaviour in such areas as fission gas release and dimensional change. A new gas release and gas bubble swelling model has been evolved to describe the behaviour of fission gas in UO_2 at temperatures below that at which columnar grain growth is experienced and this has been incorporated into a computer code (MINIPAT) for predicting gas release in AGR fuel pins. In SGHWR fuel pins, in order to calculate the temperature distribution in the fuel it is necessary to model the mechanical behaviour of fuel and cladding more accurately and this is then combined with an empirical model for gas release (SUPATRICE). A comprehensive pin model (SLEUTH) in which the detailed mechanical behaviour of fuel and cladding is combined with the new gas release and gas bubble swelling model is under development and showing promise. (auth)

13160 PERFORMANCE-LIMITING PHENOMENA IN IRRADIATED UO_2. Collins, D. A.; Hargreaves, R. (UKAEA, Windscale, Eng.). pp 50.1-50.5 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.

As a result of the fuel development programme for AGR and SGHWR systems a quantitative understanding has been built up of the processes of UO_2 fuel swelling due to solid and gaseous fission products, porosity sintering and densification, the irradiation enhanced and thermally activated creep of UO_2 and fission gas release from UO_2-pelleted fuel. The evidence on these processes that has come from observations on irradiated fuel and the quantitative relationships that have been derived to describe them are reviewed. 9 references. (auth)

13161 PETROLEUM COKE BASED GRAPHITES FOR HIGH TEMPERATURE REACTOR APPLICATIONS. Moore, R. W.; Fothergill, D.; Clark, W. L. pp 94.1-94.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.

Graphites used for British gas cooled reactor cores have progressed from the highly anisotropic PGA for Magnox reactors

to very isotropic moulded gilsonite graphites for AGRs (as supplied by AGL for the first three AGR stations at Dungeness, Hinkley Point and Hunterston). (auth)

13162 FLOW STUDIES IN THE INDUCER PART OF A CENTRIFUGAL COMPRESSOR. Bammert, K.; Mobarak, A. (Technische Univ. Hannover (F. R. Germany). Inst. fuer Stroemungsmaschinen). Atomkernenergie; 25: No. 1, 39-46(1975).

From 20th annual international gas turbine conference and products show of the ASME; Houston, Tex. (2 Mar 1975). 13 figs.; 14 refs.

For helium and carbon dioxide cooled nuclear power plants, highly loaded centrifugal compressors are used to achieve the required high pressure ratios. Since the power requirements of such compressors are large, it is important to design these compressors for high efficiencies. The design criteria for the inducer part of highly loaded radial compressors are examined. The study has shown that there are minimum relative inlet flow angles (measured from the circumferential direction) and minimum hub to tip radius ratios for satisfactory operation of the inducer. The most liable parts of flow to separation are the rear part of the inducer at the tip section and the front part of it at the hub section. Flow separation will occur in these parts if the relative flow angle at inlet and/or hub to tip radius ratio are decreased beyond certain limits. (auth)

13163 GAS-COOLED HIGH TEMPERATURE REACTOR WITH A PRIMARY GAS CIRCUIT AND A SECONDARY WATER CIRCUIT. Gabriel, H. W. (to Hochtemperatur-Reaktorbau GmbH). German (FRG) Patent 2,247,700/B/. 22 Aug 1974. 2p. (In German).

The walls of the heat exchanger and/or of the fuel elements contain cerium, yttrium, titanium, and/or zirconium for binding tritium and preventing its release from the primary cooling circuit. (GE)

Power Reactors, Non-Breeding, Otherwise Moderated

Refer also to abstracts 13046, 13159, 13160, 13659, and 13664.

13164 STATISTICAL EVALUATION OF PIN GAPS IN FUEL CLUSTERS FOR FUGEN. Hishida, H. (Mitsubishi Atomic Power Industry, Omiya, Japan); Higashi, M. Trans. Am. Nucl. Soc.; 21: 383-384(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13165 HEAVY-WATER CRITICAL EXPERIMENTS FOR FUGEN (II) CELL FLUX DISTRIBUTIONS IN PLUTONIUM LATTICE. Wakabayashi, T.; Hachiya, Y. (Power Reactor and Nuclear Fuel Development Co., Tokyo). Trans. Am. Nucl. Soc.; 21: 466-467(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13166 HEAVY-WATER CRITICAL EXPERIMENTS FOR FUGEN (I) VOID REACTIVITY IN PLUTONIUM LATTICE. Shiba, K.; Iijima, K.; Muramatsu, A.; Aihara, N. (Power Reactor and Nuclear Fuel Development Co., Tokyo). Trans. Am. Nucl. Soc.; 21: 467-468(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13167 BENCHMARK U-D_2O EXPERIMENTS AND COMPARISON WITH COMPUTATIONS. Pellarin, D. J.; Morris, B. M. (E. I. du Pont de Nemours and Co., Aiken, SC). Trans. Am. Nucl. Soc.; 21: 469-470(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13168 SGHWR FUEL ELEMENT PERFORMANCE. Pickman, D. O. (UKAEA, Springfields, Eng.); Willey, D. H.; Eldred, V. W. pp 51.1-51.6 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.

Operating experience of fuel elements in the UK prototype Steam Generating Heavy Water Reactor (SGHWR) is reviewed. After early problems arising from thick impervious crud deposits, defect experience has been very satisfactory. The results of monitoring examination are presented and the reasons for design changes that have been made discussed. Power cycling and power ramp experiments which demonstrate the freedom from operational restrictions are described. (auth)

13169 FUEL FAILURES CAUSED BY OVERPOWER RAMPS. Aas, S.; Olshausen, K. D.; Videm, K. (Institutt for Atomenergi, Kjeller, Norway). pp 55.1-55.6 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.

The lack of quantitative information about the relationships between irradiation history, operational factors and design parameters, has prompted the OECD Halden Reactor Project to conduct an experimental programme which aims at establishing such relationships. Results from the first overpower tests carried out in the Halden Reactor are presented. The emphasis is on observations from the post-irradiation examinations and on laboratory experiments which have been carried out in order to elucidate the failure mechanism. 21 references. (auth)

13170 FUEL DESIGNS TO ELIMINATE DEFECTS ON POWER INCREASES. Bain, A. S.; Wood, J. C.; Coleman, C. E. pp 56.1-56.5 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.

Defects occur in Zircaloy sheathed UO_2 fuel elements if their power output is increased significantly after a burnup of 50 MWh/kg U. The two most probable defect mechanisms, acting separately or together, are stress corrosion cracking by fission products, or rupture of the neutron-embrittled sheath in regions of high stress and strain concentrations. In laboratory tests, layers of graphite or siloxane baked onto the inside surface of the sheathing were found to inhibit stress corrosion and to decrease strain concentrations. We have demonstrated by in-reactor tests that fuel made with such coated sheathing is more tolerant to power increases than standard fuel elements irradiated under similar conditions. (auth)

13171 MATHEMATICAL MODELS FOR FUEL DESIGN AND ANALYSIS OF EXPERIMENTAL DATA. Cardosi, G. F.; Cornaggia, L.; Omarini, S. (CNEN, Rome). pp 66.1-66.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.

Two calculation methods regarding Cirene reactor type fuel elements have been developed. The first calculation method codified in the STECCA code is based on a simple fuel model and makes wide use of empirical relationships with parameters that can be adjusted to describe the phenomenology during irradiation. Creep is not taken into account and fission gas release is calculated on the basis of the temperature and burnup history. The STECCA code has been available for a few years and has been used extensively both for design and for experimental analyses. The second calculation method is codified in the CRIP-CREP code. It is based on experimental data relative to the properties of the oxide and the cladding in function of temperature and burnup and takes into account both cracking and creep deformations in both oxide and cladding. The CRIP-CREP code was used to study the importance of the different rates of approach to power for its effects on deformations and stresses in fuel and cladding. 5 references. (auth)

13172 IRRADIATION EXPERIENCE IN THE DEVELOPMENT OF A FUEL ELEMENT FOR THE PROTOTYPE CIRENE REACTOR. Bozzoni, T.; Pugnetti, G.; Valli, G. (CNEN, Rome). pp 67.1-67.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.

Irradiation of experimental fuel element in support of the Italian prototype reactor CIRENE has started at CNEN since 1966. The performance of the fuel elements is summarized with reference to general topics, such as clad deformations, corrosion and hydriding, gas release etc. Emphasis is given to the description of the fuel failure mechanism which have been experienced in the course of the programme. 5 references. (auth)

13173 OVERPOWER RAMP TESTS ON CIRENE PROTOTYPE FUEL PINS. Lysell, G. (AB Atomenergi, Studsvik, Sweden); Valli, G. pp 73.1-73.3 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.

Seven pins of an earlier CIRENE prototype fuel design were irradiated at overpower linear heat ratings after a burnup of about 2 MWd/kg U. All these pins failed either with small axial cracks at ridges on the canning or with circumferential cracks in the end plug weldings. Three other pins were irradiated at overpower

after an extra overpower transient. The duration of the extra overpower transient was varied. Only the longest transient gave a penetrating crack in the canning. (auth)

13174 OXIDATION OF ZIRCALOY-2 UNDER SIMULATED LOSS-OF-COOLANT ACCIDENT CONDITIONS AND ITS EFFECT ON ROOM-TEMPERATURE DUCTILITY OF SGHWR CLADDING. Bentley, M. J.; Mowat, J. A. S. (UKAEA, Springfields, Eng.). pp 82.1-82.5 of Nuclear Fuel Performance. Lor ion; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.

The oxidation of Zircaloy-2 by steam was studied at temperatures between 1050 and 1300°C, using metallography of sections of oxidised tubes and weight gain data from coupon specimens to assess the oxidation kinetics. Results were in good agreement with those previously obtained at ORNL by metallography, but differed appreciably from published weight-gain data. Tests in air indicated very similar oxidation kinetics to those in steam, provided that there was no trace of fluoride remaining from pickling operations on the metal surface. If fluoride was present, the rate of oxidation in air was increased by a factor of approximately 2. Rings cut from oxidised SGHWR tubes tested in compression at room temperature, were brittle if the ratio of the oxygen-rich (> 10 at.% oxygen) surface layer thickness to that of the underlying (< 2 at.% oxygen) metal was greater than 0.07. 5 references. (auth)

13175 DEFORMATION OF ZIRCALOY-2 FUEL CLADDING UNDER LOSS-OF-COOLANT. Rose, K. M.; Hindle, E. D. (UKAEA, Springfields, Eng.). pp 83.1-83.6 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.

The safety of the Winfrith SGHWR is assessed on the difference between the actual pin internal gas pressures and the maximum pressures the cladding could withstand in a loss-of-coolant accident (LOCA). These maximum pressures relate to a diametral expansion limit and must be determined for a range of calculated profiles, i.e., transients which represent the expected behaviour of the full range of the various standard and experimental fuel clusters in the SGHWR. The relation between diametral expansion and differential pressure has been studied using short isothermal tests on specimens of Zircaloy-2 cladding tube. It has been found that above about 950°C the steam environment has a marked strengthening effect on the can and also reduces its ductility. A subsidiary effect is an increase in can diameter (1%) which occurs when the zirconium reacts to form the more bulky oxide. These effects are apparent in the ballooning of cladding subject to high temperature transients. For example an SGHWR can exposed to steam in a LOCA and reaching 1100°C will withstand a differential pressure of 0.46 N/mm^2, which is the limiting differential pressure for an unoxidised can at 920°C, and retain adequate ductility for handling during discharge. 5 references. (auth)

13176 EXPERIMENT ON THE BEHAVIOR OF ZIRCONIUM ALLOY CLAD FUEL ELEMENTS OPERATING AT HIGH TEMPERATURE-EL.4 Zr-Cu ELEMENT. Ringot, C.; Orsier, G. (CEA, Saclay, France). pp 93.1-93.6 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.

Zr-Cu alloys have been developed to operate at high temperatures in carbon dioxide. A hardened alloy, which includes 1.8% of Cu, was chosen pursuant to an operational statistical experiment in an EL.4 reactor simulating the reactor future charge. The burnup ratio (20,000 MWj/tU) enables to attain a fuel cycle cost rate of less than 1 c/kWhr. 5 references. (auth)

13177 NUCLEAR HEAT IN SIDERURGY. Savioli, F.; Pasero, E.; Rosi, F. S. (CSM, Rome). Metall. Ital.; 67: No. 5, 241-247(May 1975). (In Italian).

Possibilities of using nuclear process heat as an alternative energy source in steelmaking is discussed. By comparing known technologies, for instance, blast furnace and oxygen steelmaking with the iron ore direct reduction and electric furnace melting of the produced iron sponge, a first evaluation was made of the possible nuclear contribution to cover part or all of the thermal needs of some steelmaking processes. (auth)

Power Reactors, Breeding

Refer also to abstracts 13024, 13062, 13266–13268, 13430, 13435, 13439–13441, 13446, 13453, 13458–13461, 13466, 13471, 13484–13488, 13497, 13499–13508, 13510–13517, 13520, 13521, 13524–13531, 13533–13542, 13564, 13649, and 13685.

13178 (EURFNR-1181) FAST BREEDER PROJECT: FIRST QUARTERLY REPORT, JANUARY–MARCH 1974. (Kernforschungszentrum Karlsruhe (F. R. Germany)). 1974. Translation of KFK-1274/1. 66p. Dep. NTIS $5.45.

Work performed under United States–Euratom Fast Reactor Exchange Program.

Information on the development of fast breeder reactors in the German Federal Republic is presented concerning fuel pin development, mechanical and physical properties of steels for cladding, sodium corrosion tests for SNR-300 reactor fuel cans, wet chemical extraction cycles for reactor fuels, physics experiments in SNEAK, reactor theory, reactor safety, development of instrumentation, performance for sand filters for sodium and sodium oxide aerosols, development of components for liquid sodium systems, thermodynamic and hydrodynamic tests for gas-cooled fast breeder reactor development, and design studies for large sodium breeder reactors. (DCC)

13179 (EURFNR-1207) THESYS: A FORTRAN PROGRAM FOR CALCULATION OF THE THREE-DIMENSIONAL NOMINAL TEMPERATURE DISTRIBUTION IN FAST REACTOR CORES. Doetschmann, K. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Reaktorentwicklung). Jul 1974. Translation of KFK-1997. 87p. Dep. NTIS $5.45.

Work performed under United States–Euratom Fast Reactor Exchange Program.

A method is described to calculate the three-dimensional nominal temperature distribution in a fast reactor core. Nominal means an undisturbed core geometry and steady state conditions. This nominal temperature distribution is the basis for such design calculations as hot spot analysis, core deformation, and the determination of thermal reactivity coefficients. The calculation is based on a subchannel analysis for each subassembly of the core. Such models are commonly used for calculating the temperature distribution in fluids flowing in-line in pin bundle geometry. The original part of this work lies in the adaption of the method to the whole core (or to a representative section of the core) and the solution of the numerical problems coupled with this procedure. Further, the calculation of the temperature distribution in the subassembly wrapper (which determines the core bowing) is included in the model. Therefore the heat exchange processes between neighboring subassemblies in the core are considered as well as the heat exchange processes in the subassembly itself. The influence on the temperature distribution is analyzed and it is shown that both processes have to be considered. The problem of calculating the magnitude of the heat transfer between subchannels is discussed in detail and it is shown by parametric calculations that the present uncertainties are, in general, tolerable for the task under discussion. (auth)

13180 (KFK-2106) DESIGN, IRRADIATION AND POST IRRADIATION EXAMINATION OF THE UO_2/PuO_2-FUEL PIN IRRADIATION EXPERIMENTS OF THE BR2 CAPSULE GROUP MOL 8-B. Weimar, P.; Sebening, H. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung; Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Schneller Brueter). Jan 1975. 69p. (In German). INIS.

The Mol 8-B irradiation was performed in the so-called FAFNIR-NaK-capsule. With a cadmium screen the softer neutron spectrum is filtered. The fuel consists of mixed oxide with 20 wt% PuO_2. The UO_2 is enriched to 93 wt%. The density of the pellets is 85% TD. The cladding material consists of 1.4988 austenitic steel. The outer diameter of the tubes is 6.0 mm, with a cladding thickness of 0.38 mm. The length of the pin is 851 mm. The irradiation was performed in fuel-element positions of the BR2. The pin power was 354 and 387 W/cm respectively, the mean temperatures were 549 and 597°C respectively at the hot spot. The mean burnup was 89.5 and 74 MWd/Kg Me, respectively. The irradiation time was 881 and 728 days. The pin Mol 8B-1 melted at two parts of the cladding below the distance grid. A compilation of design, specification and fabrication as well as a detailed description of irradiation and post irradiation examination results are given. (auth)

13181 (KFK-2110) STATUS AND FURTHER DEVELOPMENT TARGETS OF THE SNR FUEL ELEMENT DEVELOPMENT. Karsten, G. (Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Schneller Brueter). Nov 1974. 14p. (In German). INIS.

From KTG-special meeting; Juelich, F. R. Germany (12 Nov 1974).

Within the scope of the fuel element development program for the fast breeder reactor SNR 300, 500 fuel pins have been

irradiated since 1964, 250 of them in fast flux. The result is that the maximum nominal target burnup of 90,000 MWd/t of the SNR 300 Mk Ia possibly can be reached. The main problems, which arise from clad swelling and internal corrosion, can be met by special pretreatments of the austenitic stainless steel 1.4970 and a fuel stoichiometry of 1.97. Beyond this target, either material property improvements have to be made or burnup reductions have to be accepted. These remaining questions can be answered by the use of the SNR 300 as a test reactor. A further target is the development of a carbide fuel element. This will be very effective in a high power breeder reactor because of its low fissile inventory and high breeding gain. This development program will also be finalized in the SNR 300. (auth)

13182 (KFK-2111) MOTIVATIONS AND PERFORMANCES OF CARBIDE FUEL DEVELOPMENT. Plitz, H.; Karsten, G.; Muehling, G. (Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Schneller Brueter). Oct 1974. 14p. (AED-CONF-74-643-021). INIS.

From winter meeting of the American Nuclear Society; Washington, D. C. (27 Oct 1974).

A research and development program to develop a fuel element for a carbide fuelled power reactor is described. The fuel element concept foresees a linear rating of 800 W/cm, a pin diameter of approximately 8 mm with helium bonded pins. Because of restrictions from clad material swelling, the maximum neutron dose of about $1.5 \times 10^{23} n/cm^2 > 0.1$ MeV will limit the maximum nominal target burnup in the range of 60 – 90,000 MWd/tm. These burnups have been reached within this program without indication of principal difficulties, even under conditions of higher fuel swelling and mechanical interactions with the cladding. Therefore the present design seems to be capable to meet the target conditions. (auth)

13183 (KFK-2128) HEAT TRANSFER IN SMOOTH AND ROUGHENED ROD BUNDLES NEAR SPACER GRIDS. Marek, J.; Rehme, K. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik). Mar 1975. 47p. (In German). Dep. NTIS (US Sales Only) $5.25.

An experimental investigation was performed of the heat transfer in smooth and rough rod bundles near spacer grids. Detailed wall temperature distributions were measured which clearly demonstrated that even in rod bundles roughened by artificial roughnesses there are no hot spots near spacer grids. On the basis of the few experimental results from the literature and the new data, heat transfer correlations are proposed for smooth and rough surfaces near spacer grids. These correlations allow a prediction to be made in a good approximation of the heat transfer near spacer grids as a function of the flow contraction due to the spacer. 10 references. (auth)

13184 (KFK-EXT-6/75-1) THE CORROSION PROBLEMS IN FAST SODIUM COOLED REACTORS. Borgstedt, H. U. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung). Feb 1975. 23p. (AED-CONF-74-706-001). INIS.

From 6th session of the Arbeitsgruppe "Korrosion in der Kernenergie"; Karlsruhe, F. R. Germany (15 Oct 1974).

12 figs.; 1 tab.; 17 refs. With abstract in English and German.

A survey of corrosion problems in the components of a fast sodium-cooled reactor due to the use of sodium as a coolant is given. The survey was presented on the 6th session of the Working Group "Nuclear Corrosion", which was held at the Karlsruhe Nuclear Center on October 15 and 16, 1974. (auth)

13185 (LA-5968-PR) EXAMINATION OF FAST REACTOR FUELS, FBR ANALYTICAL QUALITY ASSURANCE STANDARDS AND METHODS, AND ANALYTICAL METHODS DEVELOPMENT-IRRADIATION TESTS. Quarterly Report, January 1–March 31, 1975. Baker, R. D. (comp.). (Los Alamos Scientific Lab., N. Mex. (USA)). May 1975. Contract W-7405-eng-36. 15p. Dep. NTIS $4.00.

Research progress is reported in the following areas: radiation effects on fast reactor materials; FBR quality assurance standards and methods; and irradiation tests for analytical methods development. (JWR)

13186 (PMC-75-02) ANNUAL REPORT TO BREEDER REACTOR CORPORATION PROJECT REVIEW COMMITTEE, APRIL 1974–MARCH 1975. (Project Management Corp., Chicago, Ill. (USA)). 1975. 32p. Dep. NTIS $4.00.

Project highlights, engineering, licensing and site activities, quality assurance, project control activities, business and finance, and the project information program are briefly discussed. (JWR)

13187 HIGH-POWER FAST REACTORS WITH JOINT USING OF URANIUM-235 AND PLUTONIUM. Ilyunin, V. G.; Kuzmin, A. M.; Murogov, V. M. (Inst. of Physics and Power Engineering, Obninsk, USSR). Ann. Nucl. Sci. Eng.; 1: No. 11/12, 561-565 (Nov 1974).

Characteristics of fast reactors with simultaneous use of ^{235}U and plutonium in the core are considered. Joint usage of uranium and plutonium fuels in a reactor is shown to result in a considerable effect both in flattening of the heat-generation field and in its stabilization. As a result a considerable increase of the power density is achieved. (auth)

13188 TOWARDS THE FAST BREEDERS MATURITY. Bonalumi, R. (CISE, Milan). Energ. Nucl. (Milan). 22: No. 4, 179-184(Apr 1975). (In Italian).

A synthesis is attempted of the mixed feelings that the writer got as an attendee of two international Conferences in 1974 (BNES-sponsored Fast Reactor Power Stations Conference in London, U. K., and ANS-sponsored Advanced Reactors Conference in Atlanta, Ga., U. S. A.). The main feeling is that, despite delays and difficulties, the fast reactors development really seems to have reached a point of no return, as testified by the remarkably flawless operation of the French Phenix: interesting enough was the widespread attitude at Atlanta of attaching the "advanced reactor" label almost exclusively to fast breeders. (auth)

13189 THE FAST REACTOR PROGRAM IN THE USA. Grenon, M. Rev. Energ.; 26: No. 269, 503-509(Jan 1975). (In French).

The vast research program for the development of fuels and materials is presented, as well as the characteristics of the FFTF reactor (under construction) and the CRFBR prototype reactor. The importance of this program and the criticisms it incurs are underlined. (FR)

13190 RADIAL PLUTONIUM REDISTRIBUTION IN MIXED OXIDE FUELS IRRADIATED IN A FAST FLUX. Bober, M.; Kleykamp, H.; Schumacher, G. (Kernforschungszentrum, Karlsruhe, Ger.). Nucl. Technol.; 26: No. 2, 172-182(Jun 1975).

Redistribution of plutonium has been examined in three hypostoichiometric mixed oxide fuel pins irradiated in the fast flux of the RAPSODIE reactor. From the results of these examinations, the effective heat of transport of thermal diffusion of plutonium is estimated. The increase in central temperature is determined with plutonium distributions calculated from thermal diffusion and estimated from postirradiation examinations, respectively. In stoichiometric fuels, a temperature increase of up to 150°C must be anticipated due to plutonium enrichment by evaporation-condensation processes, while in strongly hypostoichiometric fuels the increase in central temperature, caused in this case by thermal diffusion, does not exceed 50°C for power ratings below 450 W/cm. The radial variation of the O/(U + Pu) ratio is calculated since it strongly influences the vapor pressures of the fuel component species and therefore influences the redistribution by evaporation-condensation processes. (auth)

13191 UNLOADING SODIUM COLD TRAPS: A CONCEPT EXPLORATION. McKee, J. M. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 175(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13192 POTENTIAL ALTERNATIVE SECONDARY SYSTEM FLUIDS FOR LMFBRs. Cooper, M. H. (Westinghouse Electric Corp., Madison, PA); Lee, P. K. Trans. Am. Nucl. Soc.; 21: 175-177(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13193 INVESTIGATION OF THE WATER PURITY REQUIREMENTS AND FOULING FOR THE CRBRP STEAM GENERATORS. Casey, D.; Dutina, D. (General Electric Co., Sunnyvale, CA). Trans. Am. Nucl. Soc.; 21: 178(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13194 LIFETIME PREDICTIONS FOR MIXED-OXIDE LMFBR FUEL PINS CLAD WITH TYPE 304 STAINLESS STEEL. Jackson, R. J.; Saito, G. H.; Cox, C. M. (Westinghouse Hanford Co., Richland, WA). Trans. Am. Nucl. Soc.; 21: 188-189(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13195 MODE FAILURE LMFBR FUEL PINS. Washburn, D. F. (Westinghouse Hanford Co., Richland, WA). Trans. Am. Nucl. Soc.; 21: 189-190(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13196 OVERVIEW: DESIGN, COST, AND SCHEDULE FOR CLINCH RIVER BREEDER REACTOR PROJECT. Van Nort, P. S.

(Project Management Corp., Chicago). Trans. Am. Nucl. Soc.; 21: 356(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13197 LICENSING OF THE CLINCH RIVER BREEDER REACTOR. Bliss, H. E. (Project Management Corp., Chicago). Trans. Am. Nucl. Soc.; 21: 356-357(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13198 INTERMEDIATE HEAT TRANSPORT AND STEAM GENERATOR SYSTEMS OF CRBRP. Skavdahl, R. E. (General Electric Co., Sunnyvale, CA). Trans. Am. Nucl. Soc.; 21: 359 (Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13199 CLINCH RIVER BREEDER REACTOR PLANT REFUELING AND PLANT AUXILIARY SYSTEMS. Morgan, W. T.; Foster, K. W. (Atomics International, Canoga Park, CA). Trans. Am. Nucl. Soc.; 21: 359(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13200 CRBRP BALANCE OF PLANT HIGHLIGHTS. Young, W. H. (Burns and Roe, Inc., Oradell, NJ). Trans. Am. Nucl. Soc.; 21: 360(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13201 STEAM GENERATOR AUXILIARY HEAT REMOVAL SYSTEM FOR THE CLINCH RIVER BREEDER PLANT. Boardman, C. E.; McCarty, L. N. (General Electric Co., Sunnyvale, CA). Trans. Am. Nucl. Soc.; 21: 365(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13202 LMFBR STEAM GENERATORS OPERATION WITH FORCED RECIRCULATION AND DEPARTURE FROM NUCLEATE BOILING (DNB). Lowe, P. A. (Energy Research and Development Association, Washington, DC); Dutina, D.; Spalaris, C. N.; Kruger, G. D. Trans. Am. Nucl. Soc.; 21: 365-366(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13203 TEMPERATURE AND STRESS FLUCTUATIONS IN LMFBR EVAPORATOR TUBES. Chiang, T.; France, D. M.; Bump, T. R. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 366-367(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13204 SCALE-MODEL DEVELOPMENT TESTS PLANNED IN SUPPORT OF THE CRBRP STEAM GENERATORS. Rush, D. J.; Weinberg, L. (General Electric Co., Sunnyvale, CA). Trans. Am. Nucl. Soc.; 21: 367-368(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13205 SODIUM/WATER REACTION TESTS FOR A PROTECTED BAYONET TUBE STEAM GENERATOR. Cho, S. M.; Govignon, E. C. (Foster Wheeler Energy Corp., Livingston, NJ). Trans. Am. Nucl. Soc.; 21: 368-369(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13206 ACOUSTIC SURVEILLANCE IN LMFBR SAFETY EXPERIMENTS. Spencer, B. W.; Anderson, T. T.; Holtz, R. E.; Gavin, A. P. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 377-378(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13207 MODEL FOR PREDICTING TURBULENT TRANSPORT IN SUBCHANNEL ANALYSIS. Sha, W. T. (Argonne National Lab., IL); Carelli, M. D. Trans. Am. Nucl. Soc.; 21: 380-382 (Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13208 EFFECT OF COOLANT TEMPERATURE ON ESTIMATES OF FAST REACTOR INTERSUBASSEMBLY SPACING. Charak, I.; Bump, T. R.; Cha, B. K. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 382-383(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13209 GCFR CORE FLOW TEST LOOP. Hopkins, H. (General Atomic Co., San Diego, CA). Trans. Am. Nucl. Soc.; 21: 384-385(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13210 SELECTION OF FUEL ROD DESIGN BASIS FOR AN LMFBR. Sayles, C. W. (Atomics International, Canoga Park, CA). Trans. Am. Nucl. Soc.; 21: 388-389(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13211 RADIAL ZONING IN LARGE LMRBRs. King, M. J.; Barthold, W. P. (Argonne National Lab., TN). Trans. Am. Nucl. Soc.; 21: 389-390(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13212 EFFECT OF CORE SIZE ON FAST REACTOR BLANKET PERFORMANCE. Tagishi, A.; Driscoll, M. J. (Massachusetts Inst. of Tech., Cambridge). Trans. Am. Nucl. Soc.; 21: 390(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13213 EFFECT OF SELECTED CORE DESIGN CHANGES ON THE LMFBR DOUBLING TIME. Omberg, R. P.; Rothrock, R. B.; Hardie, R. W. (Westinghouse Hanford Co., Richland, WA). Trans. Am. Nucl. Soc.; 21: 391(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13214 PRELIMINARY ASSESSMENT OF THE IMPACT OF CARBIDE-FUELED SUBASSEMBLIES IN THE CRBRP. Vitti, J. A.; Noyes, R. C.; Gilbertson, J. C. (Combustion Engineering Inc., Windsor, CT). Trans. Am. Nucl. Soc.; 21: 391-392(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13215 GAS-COOLED FAST REACTOR FUEL ROD–GRID SPACER MECHANICAL INTERACTION TESTS. Acharya, R. T.; Ream, J. T.; Langer, S. (Georgia Inst. of Tech., Atlanta). Trans. Am. Nucl. Soc.; 21: 393(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13216 THERMAL-HYDRAULIC ANALYSES FOR CRBRP CORE-RESTRAINT DESIGN. Carelli, M. D.; Bach, C. W. (Westinghouse Electric Corp., Madison, PA). Trans. Am. Nucl. Soc.; 21: 393-395(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13217 DYNAMICS CONSIDERATIONS FOR CLINCH RIVER SODIUM COOLANT PUMPS. Manners, L. E. (General Electric Co., Sunnyvale, CA); Ogg, J. F. Trans. Am. Nucl. Soc.; 21: 395-396(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13218 HYDROSTATIC BEARINGS IN BREEDER REACTOR COOLANT PUMPS. Arwas, E. B. (Mechanical Tech. Inc., Latham, NY); Eusepi, M.; Accinelli, J. B. Trans. Am. Nucl. Soc.; 21: 396(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13219 BREEDING POTENTIAL OF 2000-MW(e) LMFBRs USING CARBIDE AND NITRIDE FUEL. Orechwa, Y.; Beitel, J.; Chang, Y. I.; Barthold, W. P. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 403-404(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13220 EFFECT OF FUEL ROD DIAMETER ON THE DOUBLING TIME FOR SODIUM-BONDED MIXED-CARBIDE-FUELED LMFBR. Sayles, C. W.; Kinzer, J. E.; Specht, E. R. (Atomics International, Canoga Park, CA). Trans. Am. Nucl. Soc.; 21: 404(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13221 OPTIMIZATION OF LINEAR HEAT RATING IN CARBIDE- AND NITRIDE-FUELED LMFBRs. Barthold, W. P.; Chang, Y. I.; Orechwa, Y. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 405(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13222 FUEL PIN DIAMETER OPTIMIZATION FOR CARBIDE- AND NITRIDE-FUELED LMFBRs. Barthold, W. P.; Beitel, J.; Chang, Y. I.; Orechwa. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 405-406(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13223 CARBIDE AND NITRIDE FUEL PIN DESIGN FOR LARGE LMFBRs. Orechwa, Y.; Chang, Y. I.; Billone, M.; Barthold, W. P. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 406-407(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13224 IMPACT OF NITROGEN ENRICHMENT ON BREEDING PERFORMANCE OF LMFBR NITRIDE FUEL. Chang, Y. I.; Barthold, W. P. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 407-408(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13225 TWO-PHASE FLOW (NITROGEN–WATER) IN A 19-ELEMENT BUNDLE WITH SPACER WIRES. Yung, D.; Pederson, D. R.; Pierce, R. D.; Quattropani, N. P. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 413-414(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13226 CALCULATED TRANSIENT RESPONSE OF AN LMFBR SUBCHANNEL IN TURBULENT FLOW. Peddicord, K. L. (Swiss Federal Inst. for Reactor Research, Wuerenlingen, Switzerland); Axford, R. A. Trans. Am. Nucl. Soc.; 21: 417-418(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13227 LMFBR OUTLET PLENUM FLOW STRATIFICATION STUDIES. Lorentz, J. J.; Carlson, R. D. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 418-419(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13228 THORIUM-BASED FUELS IN FAST BREEDER REACTORS. Sehgal, B. R.; Lin, C.; Naser, J.; Loewenstein, W. B. (Electric Power Research Inst., Palo Alto, CA). Trans. Am. Nucl. Soc.; 21: 422-423(Jun 1975).
From transaction of the American Nuclear Society 1975 annaul meeting; New Orleans, LA (8 Jun 1975).

13229 MEASUREMENT AND CALCULATION OF INTEGRAL CROSS-SECTION RATIOS IN A CENTRAL BREEDER ZONE IN A GCFR LATTICE. Seth, S.; Richmond, R. (Swiss Federal Inst., for Reactor Research, Wuerenlingen, Switzerland). Trans. Am. Nucl. Soc.; 21: 460461(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13230 PROJECTED CRBRP SPENT FUEL CHARACTERISTICS AND THEIR IMPACT ON NDA TECHNIQUES. Morrison, G. W.; Weisbin, C. R.; Kee, C. W. (Oak Ridge National Lab., TN). Trans. Am. Nucl. Soc.; 21: 487-488(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13231 NEUTRON STREAMING EFFECTS IN SIMULATED GCFR CORE. Bhattacharyya, S. K. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 497-498(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13232 PRELIMINARY SHIELDING ANALYSIS OF A REFERENCE DESIGN 300-MW(e) GAS-COOLED FAST BREEDER REACTOR. Bartine, D. E.; Williams, L. R.; Pace, J. V. III, Mynatt, F. R. (Oak Ridge National Lab., TN). Trans. Am. Nucl. Soc.; 21: 525-526(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13233 RADIAL SHIELD DESIGN CONSIDERATIONS FOR A 300-MW(e) GAS-COOLED FAST BREEDER REACTOR. Nagel, M.; Rouse, C. A.; Razani, A.; Cerbone, R. J. (General Atomic Co., San Diego, CA). Trans. Am. Nucl. Soc.; 21: 526-527(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13234 RADIATION HEATING STUDIES IN IRON AND STAINLESS-STEEL CRBR SHIELDS. Clifford, C. E. (Oak Ridge National Lab., TN); Maerker, R. E.; Muckenthaler, F. J.; Stevens, P. N. Trans. Am. Nucl. Soc.; 21: 533-534(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13235 DOSE RATE ANALYSES FOR FAST REACTOR FUEL MANUFACTURE. Smith, R. C. (Westinghouse Hanford Co., Richland, WA); Strode, J. N.; Brackenbush, L. W.; Faust, L. G. Trans. Am. Nucl. Soc.; 21: 538-539(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13236 INSTRUMENTATION FOR CORE AND COOLANT MONITORING IN LIQUID-METAL FAST BREEDER REACTORS (LMFBR). Hess, B.; Ruppert, E. (INTERATOM, Bensberg, Ger.). At. Energy Rev.; 13: No. 1, 81-144(Mar 1975).
The review on core and coolant instrumentation for liquid metal fast breeders aims to give a short survey of measurement methods and the variety of appropriate instrumentation developed and tested for reactor application throughout the world. A general outline of development, of well-known thermal reactor instrumentation and the special instrumentation demanded for LMFBR safety requirements is presented. The in-core LMFBR instrumentation is surveyed, classifying the measurement or monitoring of coolant properties such as temperature, pressure, flow, and acoustic emission and the measurement of core-kinetic quantities such as neutron flux and reactivity. Without considering the fundamentals of the measurements, the state of instrument development is reviewed and, where known, future aspects are indicated. An additional review on fuel failure detection methods and the related instrumentation distinguishes between global or whole-core detection methods and those used for localization of failures. Special attention is paid to the aspect of reactor safety and reliability as one of the major objectives of these detection methods. A summary of the protective systems and instrumentation already used or foreseen for LMFBR plants forms a transition to a very brief discussion of handling and interpretation of the multitude of data derived from the rather comprehensive LMFBR instrumentation. (auth)

13237 INSTRUMENTATION SPECIFIC TO THE SNR-300 LIQUID METAL FAST BREEDER REACTOR. Hans, R.; Mausbeck, H. (Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bensberg/Koeln (F. R. Germany)). Kerntechnik; 17: No. 3, 113-118(Mar 1975).
15 figs.
A brief review is given on process instrumentation (level, flow and pressure measuring techniques), analyzers (plugging meter, hydrogen detection and sampling system), incore instruments (temperature monitors, fuel element flowmeter, measuring device for the determination of the position, azimuthal positive and differentiation of fuel and breeder elements), and measuring, control and monitoring devices for the electric trace heating. (GE)

Research, Test, and Experimental Reactors

Refer also to abstracts 11567, 13166, 13467, 13506–13511, 13518, 13519, 13522, 13523, 13532, 13563, 13651, 13654–13657, and 13659.

13238 (ANL-CT-75-35) ACOUSTIC MEASUREMENTS IN THE EBR-II PRIMARY SYSTEM: SHORT TERM TEST NO. 1, MARCH–APRIL 1974. Anderson, T. T.; Gavin, A. P.; Bobis, J. P. (Argonne National Lab., Ill. (USA)). Apr 1975. Contract W-31-109-Eng-38. 55p. AT.
Two sodium-immersed detectors, a microphone and an acoustic waveguide, have been developed, installed, and used for monitoring acoustic background of Experimental Breeder Reactor No. II (EBR-II) in Experiment MT-3. The microphone signal is free of structural resonances which appear in the signals from accelerometers mounted on the waveguide and various reactor components. Sound pressure level decreased by an order of magnitude when the primary sodium coolant flow was reduced from 100% to 50%. At full flow and independent of reactor power, the 1-millibar r.m.s. sound pressure as sensed by the sodium-immersed microphone had the characteristics of wideband noise over the frequency range 0.6 to 40 kHz. 19 references. (auth)

13239 (ANL-CT-75-39) ANALYSIS AND ASSESSMENT OF AIRFLOW DISTRIBUTION IN FFTF-HTS/DHX. Misra, B.; Domanus, H. M.; Kistler, A.; Groth, C. (Argonne National Lab., Ill. (USA)). May 1975. Contract W-31-109-Eng-38. 36p. AT.
An evaluation of airflow measurements for the FFTF-HTS/DHX under ambient conditions was carried out to verify the soundness of design. Assessment of the airflow measurement data indicates the difficulties inherent in characterizing flow distribution in complex geometries by simple flow visualization and measurement techniques. The distribution of fluid velocity in the HTS/DHX cannot be established either from two-dimensional inviscid computer codes or from bidirectional turbine flowmeter data or from

the limited number of data obtained with conventional and articulating pitot-static probes. Only qualitative observations can be made from still photographs of yarn streamers, regarding the existence of regions of recirculation. Although fan flow data at various fan speeds are self-consistent, and agree with conventional pitot tube data taken above the tube bundle, they do not agree with turbine flowmeter data obtained above the tube bundle. Also, there is some inconsistency in the fan power requirements and estimates of air flow rates based on data taken at fan discharge. Because of the limited number of data, these discrepancies cannot be resolved. The effect of edge leakage has been found to be within tolerable limits. (auth)

13240 (ERDA-tr-33) LARGE WATER CIRCUITS. Translation of Various Pages from Italian Article from Notiziario CNEN-8-74. 9p. Dep. NTIS $3.00.

The installation of two large loops in the ESSOR Reactor is described. One loop is intended to simulate a PWR circuit and the other is intended to simulate a BWR circuit. The experimental program for the two loops is reviewed. (JWR)

13241 (HEDL-SA-927) SIMPLIFIED METHODS AND APPLICATION TO PRELIMINARY DESIGN OF PIPING FOR ELEVATED TEMPERATURE SERVICE. Severud, L. K. (Hanford Engineering Development Lab., Richland, Wash. (USA)). 1975. Contract AT(45-1)-2170. 49p. (CONF-750617-13). Dep. NTIS $5.50.

From second ASME national congress on pressure vessels and piping; San Francisco, California, USA (24 Jun 1975).

A number of simplified stress analysis methods and procedures that have been used on the FFTF project for preliminary design of piping operating at elevated temperatures are described. The rationale and considerations involved in developing the procedures and preliminary design guidelines are given. Applications of the simplified methods to a few FFTF pipelines are described and the success of these guidelines are measured by means of comparisons to pipeline designs that have had detailed Code type stress analyses. (auth)

13242 (HEDL-SA-942) FFTF FUEL PIN DESIGN PROCEDURE VERIFICATION FOR TRANSIENT OPERATION. Baars, R. E. (Hanford Engineering Development Lab., Richland, Wash. (USA)). May 1975. Contract AT(45-1)-2170. 28p. (CONF-750527-5). Dep. NTIS $4.50.

From international working group on fuel failure mechanisms; Seattle, Washington, USA (11 May 1975).

The FFTF design procedures for evaluating fuel pin transient performance are briefly reviewed, and data where available are compared with design procedure predictions. Specifically, burst conditions derived from Fuel Cladding Transient Tester (FCTT) tests and from ANL loss-of-flow tests are compared with burst pressures computed using the design procedure upon which the cladding integrity limit was based. Failure times are predicted using the design procedure for evaluation of rapid reactivity insertion accidents, for five unterminated TREAT experiments in which well characterized fuel failures were deliberately incurred. (auth)

13243 (KFK-2095) ANALYSIS OF SEFOR EXPERIMENTS. Bogensberger, H. G.; Mitzel, F.; Oosterkamp, W. J.; Wintzer, D.; Caldarola, L. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Angewandte Systemtechnik und Reaktorphysik; Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Schneller Brueter). Jan 1975. 109p. (EUR-5200e). INIS.

The analysis of several SEFOR zero power and power experiments is described. With few exceptions, the analysis of zero power experiments confirms experiences which had been obtained by more simple zero power assemblies for the more recent GfK cross section sets and calculational methods. The Doppler temperature coefficients as evaluated from several SEFOR Doppler experiments are in good agreement with GE results. The evaluated Doppler temperature coefficients are slightly overestimated by nuclear calculations. (auth)

13244 ROLE OF CRITICAL SYSTEMS IN THE DEVELOPMENT OF NUCLEAR ENERGY STATIONS. Szatmary, Z. (Kozponti Fizikai Kutato Intezet, Budapest). Fiz. Szemle; 24: No. 3, 70-74(Mar 1974). (In Hungarian).

Studies carried out with zero power level critical systems are described; they were related to pressurized water reactor to be built in Hungary. The experiments were performed to check the theoretical calculations and to ascertain the safety of the proposed system. The mathematical model involved calculation of the time-dependent composition of the material within the reactor and the spatial and neutron-energy-dependent distribution of the flux, i.e., the burnup and the criticality. The critical system with its near-zero power rating is not suited to solve the first problem but it is an excellent tool for the second. It is used to determine the effect of perturbations by irregularities in the array. In order to even out the flux density, the enrichment of the fuel is increased when going toward the outside from the center of the core. This results in the appearance of transition phenomena. The presence of the fuel element walls also results in perturbations. Other irregularities are caused by the insertion of control rods. All these questions have been successfully studied on the sixth critical assembly, the ZR-6, in Hungary. (TTT)

13245 ANALYSIS OF DYNAMIC PERTURBATIONS IN THE RA-2 ZERO POWER REACTOR. Porto, J. (CNEA, Buenos Aires). Ann. Nucl. Sci. Eng.; 1: No. 11/12, 567-572(Nov 1974).

Transfer function measurements were conducted in the RA-2 zero power reactor assembly using the cross-correlation technique of noise analysis. Perturbations found in the experimental curves did not allow an accurate evaluation of the prompt-neutron decay constant. The source of the perturbations was found to arise from mechanical vibrations transmitted to the control rods. Dynamically stimulated oscillations induced in both a control rod and a small piece of cadmium were analyzed. Their behavior was compared with results from a reactor model developed from both analog and digital computations; a strong distortion in the power spectral density was found for the control rod oscillation. Reactor responses to sinusoidal reactivities of various amplitudes (0.05 to 3.00 dollars) and frequencies (0.01 to 100 Hz) were computed. The inverse problem, i.e., predicting reactor input from a given output, was also studied. Both calculated and measured power spectral densities are shown. (auth)

13246 HEAVY WATER ZERO-POWER REACTOR. Hron, M.; Vorisek, M. (Inst. of Nuclear Research, Rez, Czech.). At. Energ. (USSR); 38: No. 4, 203-208(Apr 1975). (In Russian).

Criticality of the heavy water zero-power TR-0 reactor was reached for the first time on July 14, 1972. The basic units of its engineering equipment, i.e., the reactor vessel, fuel element, heavy water circuits, and reactor control systems are briefly described. Data on experimental equipment and the corresponding experimental program are also given. The most important measurements carried out on the TR-0 reactor during physical start-up of the first Czechoslovakian nuclear power plant A-1 are presented. (auth)

13247 ON THE POSSIBLE CONNECTION BETWEEN THE CENTRAL WORTH DISCREPANCY AND THE DOLLAR DISCREPANCY. Brunson, G. S. (Argonne National Lab., Idaho Falls, Idaho (USA)). Nucl. Instrum. Methods; 125: No. 1, 139-147(15 Mar 1975).

The dollar discrepancy is the amount by which the extrapolation of the prompt decay constant in a fast critical assembly exceeds the expected intercept at one dollar above delayed critical. At first glance this anomaly seems related to the well-known central worth discrepancy. This paper collates available data on the dollar discrepancy and tests the trends against the characteristics which have been found associated with the central worth discrepancy. The results are inconclusive, but an interesting relationship has been found between dollar discrepancy and the disparity in the time characteristics of the core and reflector. The results qualitatively fit a two-region model which was used earlier to describe the die-away of neutron pulses in some systems built in ZPR-III. Current research tends to bury the problem in large engineering mockups with complex geometries and a multiplicity of materials; further research is needed in very simple systems. (auth)

13248 DEVELOPMENTS IN FFTF FUEL ROD CALORIMETRIC ASSAY. Beyer, N. S.; Perry, R. B. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 118-119(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13249 SEMIEMPIRICAL CORRELATIONS FOR THE FISSION GAS RELEASE FROM FAST REACTOR FUELS. Hofman, G. L.; Johnson, D. L. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 179-180(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13250 DESIGN AND FABRICATION OF THE SECOND HEDL INSTRUMENTED CONTROL MATERIALS IRRADIATION TEST ASSEMBLY (BICM-2). Vogel, M. A.; Jackson, J. L.; (Westinghouse Hanford Co., Richland, WA). Trans. Am. Nucl. Soc.; 21: 192-193(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13251 FABRICATION OF INTERNALLY INSTRUMENTED REACTOR FUEL RODS. Schmutz, J. D.; Wilkins, S. C.; Meservey, R. H. (Aerojet Nuclear Co., Idaho Falls, ID). Trans. Am. Nucl. Soc.; 21: 193-194(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13252 DYNAMIC TESTING AND ANALYSIS OF HTGR FUEL CAPSULES IN THE HFIR. Sides, W. H. Jr. (Oak Ridge National Lab., TN); Thakkar, J. G.; Swander, J. E.; Kerlin, T. W. Trans. Am. Nucl. Soc.; 21: 373-374(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13253 GAS TAG DESIGN FOR CORES I-IV OF FFTF. McCormick, N. J. (Science Applications, Inc., La Jolla, CA); Schenter, R. E.; Omberg, R. P. (Westinghouse Hanford Co., Richland, WA). Trans. Am. Nucl. Soc.; 21: 376-377(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13254 EXPERIMENTAL ANALYSIS OF HEAT TRANSFER IN RECTANGULAR FLOW CHANNELS UNDER TYPICAL POOL-REACTOR CONDITIONS. Guerrero, H. H. (Combustion Engineering, Inc., Windsor, CT); Kelly, J. L.; Erdman, C. A. Trans. Am. Nucl. Soc.; 21: 409-410(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13255 EBR-II CORE THERMAL-HYDRAULIC PERTURBATIONS INDUCED BY POST-SHUTDOWN OPERATIONS. Price, C. C.; Sackett, J. I.; Dean, E. M. (Argonne National Lab., Idaho Falls, ID). Trans. Am. Nucl. Soc.; 21: 415-417(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13256 PRELIMINARY STUDY OF ADVANCED FTR DRIVER CORES. Rothrock, R. B. (Westinghouse Hanford Co., Richland, WA). Trans. Am. Nucl. Soc.; 21: 421-422(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13257 USAEC-INEL ADVANCED TEST REACTOR EMERGENCY-COOLING FLOW-INSTABILITY EXPERIMENT. Hanson, G. H.; Griebenow, M. L.; Wells, R. A. (Aerojet Nuclear Co., Idaho Falls, ID). Trans. Am. Nucl. Soc.; 21: 434-436(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13258 EVALUATION OF INITIAL LOADING COUNT RATE DATA FOR THE FFTF FROM CRITICAL EXPERIMENTS WITH A MOCKUP CORE. Mihalczo, J. T.; Tillett, G. C.; Selby, D. (Oak Ridge National Lab., TN). Trans. Am. Nucl. Soc.; 21: 436-437(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13259 PULSE BROADENING EXPERIMENTS AT THE WHITE SANDS FAST BURST REACTOR (FBR). Welch, D. L.; De La Paz, A. (Nuclear Weapon Effects Branch, White Sands Missile Range, NM). Trans. Am. Nucl. Soc.; 21: 437(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13260 MONTE CARLO ANALYSIS OF ZPR HETEROGENEITY. Wade, D. C. (Argonne National Lab., IL); Lineberry, M. J.; Prael, R. E. Trans. Am. Nucl. Soc.; 21: 446-447(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13261 FISSION RATE MEASUREMENTS IN THE HIGH-^{240}Pu SECTOR OF THE FTR-EMC. Morman, J. A.; Armani, R. J.; Robinson, W. R. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 447-448(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13262 SODIUM-VOID MEASUREMENTS IN THE HIGH-^{240}Pu ZONE OF THE FTR-EMC. Morman, J. A.; Robinson, W. R.; Pond, R. B. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 448-449(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13263 POWER SPECTRAL DENSITY MEASUREMENTS WITH ^{252}Cf FOR A MOCKUP OF THE FFTF. Mihalczo, J. T.; Pare, V. K.; Mathis, M. V. (Oak Ridge National Lab., TN). Trans. Am. Nucl. Soc.; 21: 449-450(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13264 FRT TAG BURNUP. Kidman, R. B. (Los Alamos Scientific Lab., NM). Trans. Am. Nucl. Soc.; 21: 452-453(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13265 TRANSVERSE GAP REACTIVITY WORTH FOR SPLIT-TABLE CRITICAL ASSEMBLIES. dos Reis Filho, P. E. G.; Hukai, R. Y. (Instituto de Energia Atomica, Sao Paulo, Brazil). Trans. Am. Nucl. Soc.; 21: 455(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13266 PLUTONIUM ISOTOPIC EXPERIMENTS IN THE DEMO BENCHMARK ZPPR ASSEMBLY 4. McFarlane, H. F.; Beck, C. L. (Argonne National Lab., Idaho Falls, ID). Trans. Am. Nucl. Soc.; 21: 455-456(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13267 ^{240}Pu ABSORPTION-TO-FISSION RATIO MEASUREMENTS IN A FAST REACTOR SPECTRUM. Bretscher, M. M. (Argonne National Lab., IL); Gasidlo, J. M.; Maddison, D. W. Trans. Am. Nucl. Soc.; 21: 456-457(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13268 MEASUREMENT OF DELAYED-NEUTRON PARAMETERS IN AN LMFBR DEMONSTRATION REACTOR CRITICAL ASSEMBLY. Carpenter, S. G.; Goin, R. W. (Argonne National Lab., Idaho Falls, ID). Trans. Am. Nucl. Soc.; 21: 459-460(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13269 NEUTRON FLUX COMPUTATIONAL MODEL OF THE OAK RIDGE RESEARCH REACTOR. Allen, E. J.; Kerr, H. T. (Oak Ridge National Lab., TN). Trans. Am. Nucl. Soc.; 21: 461-462(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13270 OPERATION OF A HIGH-INTENSITY THERMAL-NEUTRON FLUX TRAP. Dunn, T. A. (Ballistic Research Labs., Aberdeen Proving Ground, MD). Trans. Am. Nucl. Soc.; 21: 527(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

Production and Materials Testing and Processing Reactors

13271 (HW-79948) GRAPHITE TEMPERATURE MONITORING IN N REACTOR. Giberson, R. C. (United Nuclear Industries, Inc., Richland, Wash. (USA)). 15 Jan 1964. Contract AT(45-1)-1857. 15p. Dep. NTIS $4.00.
A description of the thermocouple system used to monitor the core graphite temperature of the N Reactor is presented. (auth)

13272 (UNI-SA-11) DECONTAMINATION EXPERIENCE AT THE HANFORD N REACTOR. Kratzer, W. K.; Larrick, A. P.; Corbit, C. D. (United Nuclear Industries, Inc., Richland, Wash. (USA)). 15 Apr 1975. Contract AT(45-1)-1857. 6p. (CONF-750537-1). Dep. NTIS $4.00.
From seminar on decontamination of nuclear plants; Columbus, Ohio, USA (7 May 1975).
Experience in decontamination of reactor components, particularly cooling system pipes and steam generators, is reviewed. (JWR)

13273 COMPARISON OF MEASURED AND CALCULATED VOID REACTIVITY WORTHS IN LARGE HEAVY-WATER-MODERATED REACTORS. Ahlfeld, C. E.; Pryor, R. J. (E. I. du Pont de Nemours and Co., Aiken, SC). Trans. Am. Nucl. Soc.; 21: 468-469(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13274 BEHAVIOR OF 3m LONG BY 36mm DIAMETER SOLID UO_2 FUEL RODS. Bain, A. S. pp 57.1-57.6 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).
From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.
Forty-six 3 m long fuel elements consisting of 36 mm diameter solid UO_2 pellets sheathed in aluminum were irradiated in low flux regions of the NRX reactor. The coolant was at 340 K and 7

bars pressure. Under normal operating conditions the maximum linear power output at the centre of the cosine flux distribution was 98.0 kW/m, with a fuel surface temperature of 425°K and a fuel central temperature of 2875°K. The performance was good; dimensional changes and fission gas releases were low. One rod defected when an unusual configuration of the adjuster rods caused a very localized peak in the neutron flux, sufficient to cause melting of the UO_2. The sheath was not able to accommodate the incremental expansion and a longitudinal split occurred. 11 references. (auth)

Propulsion and Package Reactors

Refer also to abstracts 11317, 11631, 12148, 13448–13451, 13464, and 13644–13646.

13275 (AGC-2301) RADIATION EFFECTS FACILITY OPERATIONAL REQUIREMENTS. (Aerojet-General Corp., Sacramento, Calif. (USA)). Jun 1962. 39p. Dep. NTIS $5.00.

Declassified 7 Sep 1973.

Definitive operational requirements are given for determining the criteria needed in the design of a Radiation Effects Facility (REF) to be used in the conduct of Systems Irradiation Experiments (SIE) for the NERVA engine development program. (auth)

13276 (AGC-2302A) NERVA MATERIALS PROGRAM, PROJECT NERVA. (Aerojet-General Corp., Sacramento, Calif. (USA)). Jun 1962. 122p. Dep. NTIS $9.25.

Declassified 7 Sep 1973.

The problems associated with the selection of a material for a specific application in a nuclear rocket propulsion system are related to the performance requirements, environmental conditions, and design criteria. Perhaps the most important requirement connected with the selection of the structural materials for the NERVA engine is the expected resistance to high intensity nuclear radiation in combination with operating ability at high and/or cryogenic temperatures, space vacuum and hydrogen working fluid. Limited data on the physical and mechanical properties of materials under these conditions makes this selection very difficult and inevitably requires performance of a number of tests. The materials evaluation program for the NERVA Project is pursuing the following objectives: Review all engine components, design requirements and candidate materials; estimate the approximate range of environmental, operational, and irradiation conditions for each component; review all available data on mechanical and physical properties of each candidate material; establish requirements for obtaining presently unavailable data on material properties needed in the design; review the radiation and environmental effects on the materials; and provide design properties for all materials used in the NERVA engine. Presently available materials properties and the results of some special materials investigations are included. (auth)

13277 (AGC-2317) MODIFICATION SPECIFICATION: TEST CELL A IN SUPPORT OF THE NRX-NERVA DEVELOPMENT. (Aerojet-General Corp., Sacramento, Calif. (USA)). 5 Sep 1962. 105p. Dep. NTIS $8.25.

Declassified 10 Sep 1973.

A series of NERVA reactor development tests (NRX) are planned using Test Cell "A". A detailed discussion of the NRX test requirements, including the facilities, instrumentation, data system, and test stand requirements to support the NRX tests of the NERVA Engine Program is presented. The modifications to Test Cell "A" to support the NRX tests and to provide minimal Test Cell "A" and "C" interference are detailed along with the additional equipment and instrumentation requirements. A run duration analysis is presented in support of the planning for the expansion of LH_2, GH_2, and GN_2 systems. (auth)

13278 (AGC-2319) RADIATION EFFECTS FACILITY (REF) CONCEPTUAL DESIGN, NERVA TPA/ASTR FACILITY. (Aerojet-General Corp., Sacramento, Calif. (USA)). 30 Sep 1962. 206p. Dep. NTIS $13.50.

Declassified 10 Sep 1973.

The need exists to development-test certain components and subassemblies of nuclear engines, under simulated engine operating conditions, including nuclear radiation, prior to the testing of a complete engine. The modification of the General Dynamics/Fort Worth ASTR facility for this specific purpose has been investigated from the standpoint of feasibility, experimental operation, scheduling, and costs. The proposed modifications will provide adequate and satisfactory test capabilities for Radiation Effects Testing of a NERVA turbopump assembly and associated components, while operating at flow rates, temperatures, pressures, and with working fluids of the NERVA Engine. The peculiar hazards associated with this unique type of testing have been recognized and examined. Precautions have been taken to design adequate protection for the reactor against a "worst plausible accident." (auth)

13279 (LMSC-A-976106) NUCLEAR SHUTTLE SYSTEM DEFINITION STUDY. Phase III. Performance Review. (Lockheed Missiles and Space Co., Sunnyvale, Calif. (USA)). 3 Sep 1970. 166p. Dep. NTIS $11.50.

Features of the nuclear shuttle definition study were reviewed as follows: mission definition (transport between earth orbit, lunar orbit or geosynchronous orbit), propellant optimization, prelaunch operations, module characteristics, transport, earth launch, ground support, checkout philosophy, assembly in space, reactor start-up, shielding, maintenance, extravehicular work systems, typical payloads, tank pressure and pressurization requirements (for reactor start-up). (LTN)

13280 (LMSC-A-981482) NUCLEAR SHUTTLE SYSTEM DEFINITION STUDY. Phase III. Performance Review. (Lockheed Missiles and Space Co., Sunnyvale, Calif. (USA)). 17 Dec 1970. 188p. Dep. NTIS $12.50.

Various requirements, design criteria, and design optimization study results are presented. (LTN)

13281 (LMSC-A-984555(Vol.2)(Pt.A)) NUCLEAR SHUTTLE SYSTEMS DEFINITION STUDY. Phase III. Volume II. Concept and Feasibility Analysis. Part A. System Evaluation and Capability. Final Report. (Lockheed Missiles and Space Co., Sunnyvale, Calif. (USA)). 1 May 1971. 520p. Dep. NTIS $29.00.

Mission capability analyses, operations analyses, and vehicle systems and subsystems analyses of the Reusable Nuclear Shuttle are described. The mission capability analysis was directed toward establishing representative performance and mission sizing data. The operations analysis included preorbital, orbital, and flight operations. The vehicle systems and subsystems analyses included concept comparisons, subsystem analyses, radiation analyses, thermodynamic analyses, and an alternate configuration definition. An alternate configuration, carrying approximately 300,000 pounds of hydrogen, was defined and its performance established. (auth)

13282 (LMSC-A-984555(Vol.3)) NUCLEAR SHUTTLE SYSTEMS DEFINITION STUDY. Phase III. Volume III. Program Support Requirements. Final Report. (Lockheed Missiles and Space Co., Sunnyvale, Calif. (USA)). 1 May 1971. 174p. Dep. NTIS $11.75.

The planned program support requirements for the Reusable Nuclear Shuttle (RNS) Development Program are described. The approach has been to present the data for development testing, manufacturing, facilities; supporting research and technology in terms of requirements; and to summarize and integrate these requirements. The Integrated Test Plan presents a plan to accomplish all of the test objectives for the development and flight test of the multiple-tank Reusable Nuclear Shuttle. This includes consideration of all Research and Development Test Programs, Qualification Test Programs, Acceptance Test Programs, and Flight Test Plan. The test article and facility requirements to accomplish the individual test programs are identified. The Manufacturing Requirements section presents the sequence of operations, techniques, and hardware flow for the fabrication and assembly of three RNS Modules. In addition, the basic functional requirements are identified and the requirements for floor area, hook height, and crane capacity to accomplish those functions are described. The Facilities Requirements section summarizes the manufacturing facilities and test facility requirements. These facilities were examined for commonalities. Existing facilities were examined and assigned to perform specific tasks; where no existing facility could logically be used or found, new requirements were identified. The Supporting Research and Technology section summarizes the SR&T requirements identified to support the development of the RNS multi-tank concept. Finally, the Integrated Program Plan integrates the various requirements and plans presented above and phases them in the form of a Major Milestone Schedule. This section also presents the systems engineering plan and identifies the major program constraints by program phases. (auth)

13283 (LMSC-A-984555(Vol.5)) NUCLEAR SHUTTLE SYSTEMS DEFINITION STUDY. Phase III. Volume V. Schedules, Milestones, and Networks. Final Report. (Lockheed Missiles and Space Co., Sunnyvale, Calif. (USA)). 1 May 1971. Dep. NTIS $4.25.

The planned program schedules for the Reusable Nuclear Shuttle (RNS) are more detailed depictions of the major tasks appearing on the Master Phasing Schedule and comprise the following: Supporting Research and Technology (SRT) Schedule,

System Engineering and Design (SE&D) Schedule, Test Schedule Manufacturing Schedule, Facilities Schedule, and Program Operations Schedule. In the SRT schedule studies and tradeoffs are accomplished for structures, insulation, meteoroid shield, mechanisms and the propulsion system. Test specimens are fabricated prior to undergoing feasibility testing. The SE&D schedule depicts major system engineering reviews, inspections, demonstrations and specification completion dates. In addition, design spans for RNS hardware and facilities are shown. The Test Schedule reflects the test spans for feasibility and breadboard testing and the engineering mockup. All testing to be accomplished on each module is depicted by a time-phased bar. The Manufacturing Schedule complements the Test Schedule in that as each module or component completes fabrication, assembly, and test, it begins verification, qualification, or acceptance testing. The Facilities Schedule reflects the spans or time for design, construction, modification, installation and checkout, and on validation of each required facility. Ready-for-use dates support the manufacturing, test, and operations requirements of the other schedules. The Program Operations Schedule depicts all operations performed on the hardware from ship to IOC. For example, it shows the specific modules and need dates for launch facility validation and pre-deployment and deployment operations. The schedule reflects those major items which are spare/backup to the flight test vehicle and the first operational vehicle, which is ready to start deployment operations on the IOC date. (auth)

13284 (LMSC-A-984555(Vol.7)) NUCLEAR SHUTTLE SYSTEMS DEFINITION STUDY. Phase III. Volume VII. RNS Tank Pressurization Analysis. (Lockheed Missiles and Space Co., Sunnyvale, Calif. (USA)). 1 May 1971. 54p. Dep. NTIS $5.75.

The analyses have shown that the maximum pressurant flowrate required to satisfy NERVA startup requirements is proportional to the tank ullage volume and the difference between the propellant saturation pressure and the operating pressure at the start of a burn. Results of mission performance calculations using optimized data show that the multiple, small-tank configuration requires the smallest values of maximum pressurant flowrates. These calculations also show that the tracking mode of pressurization results in lowest values of maximum pressurant flowrates for any given configuration. The optimization calculations show that the range of tank operating pressures is very small for a broad range of configurations. The multiple, small-tank systems operate best at low operating pressures, and with the lowest vent pressures. Furthermore, virtually no difference is observed for the system when operating in either the track or the step pressurization mode. Because only the active propellant modules are pressurized, total propellant heating due to addition of hot pressurant gas is minimized for the multiple-tank system, resulting in lower boiloff losses for this system than with other configurations. Operation of the multiple-tank system with the engine in the malfunction mode requires an increase in tank pressure of only 0.76 psi more than that used with normal mode operation. (auth)

13285 (LMSC-A-984555(Vol.8)) NUCLEAR SHUTTLE SYSTEMS DEFINITION STUDY. Phase III. Volume VIII. RNS Test Program Requirements, NRDS. Final Report. (Lockheed Missiles and Space Co., Sunnyvale, Calif. (USA)). 1 May 1971. 136p. Dep. NTIS $10.00.

The overall test requirements for the Reusable Nuclear Stage/NERVA integrated systems testing at the Nuclear Rocket Development Stations (NRDS), Jackass Flats, Nevada are presented. The specific intent has been to provide direct support in the preliminary engineering and design of the Engine/Stage Test Stand (E/STS-2) complex at NRDS. As the final RNS design configuration has not been selected, major emphasis was directed toward evaluating the impact on facility design and operation as related to the various candidate concepts. Unique test stand requirements related to specific configurations were identified. Most notable is the impact on the various test article envelopes and weights on design of the test stand umbilical tower, support, and fluid requirements. Specific analyses from prior studies relating to in-flight environment simulation, GTM design, test operational sequences, service system requirements, stage test requirements, instrumentation and control, GSE, radiation and thermal environment during and after test, personnel access, remote handling requirements, and interface definitions were reviewed and utilized wherever they were applicable. (auth)

13286 (MDC-G-0671) NUCLEAR SHUTTLE DEFINITION STUDY. Phase III. First Interim Briefing. (McDonnell Douglas Astronautics Co., Huntington Beach, Calif. (USA)). 2 Sep 1970. 235p. Dep. NTIS $14.75.

Feasibility studies related to the Reusable Nuclear Shuttle definition were reported. Included were: reliability improvement, meteoroid protection, nuclear safety assembly, maintenance, propellant resupply, aftercooling system, mechanical stability, mission performance, control systems, and configuration. (LTN)

13287 (MDC-G-0747) NUCLEAR SHUTTLE DEFINITION STUDY. Phase III. Second Interim Briefing. (McDonnell Douglas Astronautics Co., Huntington Beach, Calif. (USA)). 16 Dec 1970. 151p. Dep. NTIS $10.75.

Various design, analysis and feasibility studies are reported. (LTN)

13288 (MDC-G-2134(Vol. 3)(Pt. B)) NUCLEAR SHUTTLE SYSTEM DEFINITION STUDY. Phase III. Final Report. Volume III. Program Support Requirements. Part B. Class 3 RNS. (McDonnell Douglas Astronautics Co., Huntington Beach, Calif. (USA)). May 1971. 229p. Dep. NTIS $14.50.

The program support requirements for the Class 3 reusable nuclear shuttle (RNS) are developed. The results of the test definition effort were used to define ground test and flight test plans for the RNS, which are described. The definition and evaluation of all candidate component, subsystem, and system tests within the categories of research and technology testing, development, qualification, acceptance, and reliability testing are considered. Test hardware, ground support equipment, and facilities required to support the test program are defined. Manufacturing requirements are described, with the candidate manufacturing and assembly techniques for each of the RNS modules being treated. Various candidate location combinations were considered for the detail fabrication and final assembly operations and are discussed along with special trade studies performed on manufacturing methods. The results of the comparative evaluations formed the bases for a recommended manufacturing approach, which is documented in the form of a preliminary manufacturing plan. The specific subjects treated in the manufacturing plan reflect the format specified in the RFQ statement of work. Results of the facilities definition effort are described, with the facilities requirements being treated under the categories of manufacturing, test, and launch. A facilities utilization study was also performed to assess the compatibility of currently available government and contractor facilities with the support facility requirements defined for the RNS, and the results are summarized. Estimates of the costs and schedules associated with the development of the required facilities are presented. The program definition effort is documented including the program assumptions and guidelines, NERVA program characteristics, critical program milestones, and interfacing system elements. An integrated program plan in the form of a master phasing schedule, program schedules and milestones, an operations plan, and a discussion of integrated support requirements are presented. (auth)

13289 (MDC-G-2134(Vol. 3)(Pt. C)) NUCLEAR SHUTTLE SYSTEM DEFINITION STUDY. Phase III. Final Report. Volume III. Program Support Requirements. Part C. Test Program Analyses and SRT Requirements. (McDonnell Douglas Astronautics Co., Huntington Beach, Calif. (USA)). May 1971. 228p. Dep. NTIS $14.50.

SRT requirements for the RNS, which were identified and documented in the Phase II final report, were reviewed in considering Phase III design requirements and the current RNS design concept to quantify the magnitude of their potential impacts on the design. Also, additional significant items have been added to the list as a result of the evaluation of RNS operations during the current study. No feasibility problems have been found which would prevent a commitment to development of the RNS. However, there are SRT questions concerning some baseline subsystem features. The nature of the required SRT is identified for various items together with their impact on the RNS. Most of these can be classified as uncertainties in the design criteria which are applied. Although best judgments of these have been applied conservatively for the RNS, experimental data are required to verify and refine the applicable criteria. The estimated weight penalties are indicated on the basis of the anticipated design alternative or a more conservative criterion. The major areas treated in detail include structures, thermal/meteoroid protection systems, propulsion, and astrionics. The SRT requirements and recommended programs are delineated in each area, including requirements for orbital experiments, as appropriate. Detailed test programs have been developed for 209 components grouped into 108 test items (i.e., some components tested in assembled units). A number of systems tests have been developed to investigate interface and interaction problems and performance under abnormal conditions. (auth)

13290 (MDC-G-2134(Vol. 5)) NUCLEAR SHUTTLE SYSTEM DEFINITION STUDY. Phase III. Final Report. Volume V. Schedules, Milestones, and Networks. (McDonnell Douglas Astronautics Co., Huntington Beach, Calif. (USA)). May 1971. 43p. Dep. NTIS $5.25.

A total Reusable Nuclear Shuttle program summary is presented, which includes the major assumptions and guidelines used in the Phase III effort as well as the master programs and phasing schedules for the Class 1 Hybrid and Class 3 RNS concepts. The supporting research and technology program schedules for both high-priority and product-improvement items are presented. The schedule for system engineering and design activities is provided. Separate schedules for the testing, manufacturing, and facilities efforts have been defined for each RNS concept. Finally, the planned utilization schedules with RNS operations for the various mission rates are discussed along with a summary description of earth orbit and lunar orbit activities. (auth)

13291 (MDC-G-2134(Vol. 6)) NUCLEAR SHUTTLE SYSTEM DEFINITION STUDY. Phase III. Final Report. Volume VI. Reliability and Safety Analysis. (McDonnell Douglas Astronautics Co., Huntington Beach, Calif. (USA)). May 1971. 428p. Dep. NTIS $24.50.

Reliability and safety analyses were performed for the Phase III Study of the Class 1 Hybrid RNS and the Class 3 RNS as an integrated effort using the philosophy that the key to safety is reliability. The premise is that if a properly designed system performs in the manner intended, it will not create a safety problem. The reliability analysis investigated every failure mode of every component of major subsystems, except structures, on the RNS system to determine the effect of a failure. The items that could cause loss of the RNS were identified as flight critical items and were quantified in a single failure analysis. These items were then ranked in order of decreasing criticalities, and a reliability prediction of the RNS was made. The safety analysis extended this reliability analysis by an investigation of the flight critical items and definition of a series of recommendations for elimination of the flight critical status, or reduction in its probability of occurrence. Multiple failures were investigated in a top-down fault tree analysis. An abort analysis was performed to determine the operational problems caused by failures during the mission. The abort analysis and the failures were then combined to produce a contingency plan, i.e., a plan of action to follow if a failure occurs. The safety effort was concentrated on the elimination or reduction of specific failures and thus the reduction of the overall probability of failure (and creation of safety problems) to a minimum. The primary concern at this time is that the reliability and safety analyses and subsequent recommendations and inputs be available at an early date in sufficient time to affect the design effort. The results of the reliability analysis, including the failure mode effects analysis (FMEA) and criticality analysis, are presented. The contingency planning work sheets (CPWS), fault trees, abort analysis, and contingency plan comprising the total safety analysis effort are included. (auth)

13292 (MDC-G-2284) NUCLEAR SHUTTLE DEFINITION STUDY. Phase III. Final Briefing. (McDonnell Douglas Astronautics Co., Huntington Beach, Calif. (USA)). 14 April 1971. 192p. Dep. NTIS $12.75.

Conclusions of phase III of the Reusable Nuclear Shuttle Study are reported. All of the operations or design features selected appear to be feasible within 1974 state of the art. Automatic rendezvous and docking, onboard checkout, propellant management, orbital assembly support systems and component reliability do not appear to be limiting problems. Using load minimum flight-control techniques to launch the Class 1 H propellant module minimizes any requirement for structural modifications to the Intermediate 21 launch vehicle. The Hybrid concept for the Class 1 has a number of major advantages over the standard configuration. The module docking interface facilitates NERVA replacement. As mentioned above, it imposes reduced design requirements upon the Intermediate-21. Although additional structure weight is required, lower shielding and improved propellant management result in an overall performance advantage for the hybrid configuration. Based upon orbital assembly operations, which permit use of a space tug as a support system without incurring additional tolerance buildup factors between adjacent parallel modules, a cruciform Class 3 configuration was selected. The maintenance concept employed on the Class 3 has been adopted for the Class 1H. Command and control module is recycled to the ground after each mission. Where possible, all subsystems are placed in the CCM to minimize the number of unreliable elements that must be maintained in orbit. No operational fluid connections have to be made between the CCM and propellant modules; only a flow-through connection, used for orbital tanking, has to be made. Electrical connections, primarily associated with the Emergency Detection System, have to be made. The RNS system tends to be independent for most of its required operations. Orbital assembly is accomplished without direct manned support with automated rendezvous and docking; remote fluid and electrical couplings are provided between modules; and an automatic leak check is provided to verify assembly interfaces. On board checkout capability is provided for orbital checkout operations. Additional processor rate requirements are minimal. Autonomous navigation and guidance capability and onboard data evaluation are provided by the RNS. (auth)

13293 (MDC-G-2705(Ph. 4)) REUSABLE NUCLEAR STAGE SYSTEM DEFINITION STUDY. Phase IV. First Interim Briefing. (McDonnell Douglas Astronautics Co., Huntington Beach, Calif. (USA)). Dec 1971. 168p. Dep. NTIS $11.50.

Modular RNS concepts compatible with promising new launch vehicles and launch modes other than those previously studied are examined. The prospect of significant improvements in RNS system performance was identified for the new RNS configurations, launch and logistics concepts which are being investigated during Phase IV. The first class entails use of a space shuttle booster together with an alternate second stage to launch RNS propellant modules to orbit. The second class of RNS systems retains the space shuttle orbiter for delivery to orbit, but mounts the modules external to the orbiter. The results of this effort, which has been concerned with identification of the most promising RNS concepts within these two classes of launch configurations, are reported. (auth)

13294 (RN-DR-0004) KIWI B-4D DESIGN REVIEW. (Aerojet-General Corp., Azusa, Calif. (USA)). Feb 1964. 71p. Dep. NTIS $6.75.

Declassified 10 Sep 1973.

The results of a review and evaluation of the Kiwi B-4D reactor design are presented. The objectives were two-fold: To check dimensions and tolerances of all critical components at ambient, cold flow, and hot firing conditions to insure component fit; and to evaluate performance characteristics of critical components, based upon thermal and mechanical analyses, and upon a review of the operating procedures used during cold flow and hot firing testing. The review is not an exhaustive study of the Kiwi B-4D design. Instead, the intent has been to investigate only the most critical areas to a degree sufficient to establish the adequacy of the present design and procedures, and to recommend changes where it was deemed appropriate. This review, and the resulting recommendations, are based upon the design current as of 3 October 1963. Design changes made between 3 October 1963 and 7 February 1964, partly as a result of this review, are presented in order to update the basic design description. (auth)

13295 (RN-S-0021) FRAGMENTATION RESEARCH PROGRAM. (Aerojet-General Corp., Azusa, Calif. (USA)). May 1964. 184p. Dep. NTIS $12.25.

Declassified 7 Sep 1973.

The basic mechanisms of graphite fracture resulting from destruction of the NERVA engine reactor core by explosive means are described. It was determined that the prime core fragmenting mechanism is mechanical interaction between neighboring core elements and engine structure produced by the explosive pressure waves. Explosive shock is effective in reducing the core material to dust sized particles in a zone very near the explosive detonation centers. It was determined that the anisotropic nature of the reactor design, its structural components, and the core material (on a microcrystalline basis) strongly impede the capability of completely pulverizing the core material in spite of the application of large quantities of explosive energy. It is suspected that application of an explosive destruct system during engine operation or while the engine is under elevated temperature will increase the formation of plastically deformed core material and consequently reduce the degree of fragmentation produced. All of the data and analyses on which these conclusions are based were derived from simulated core material tested at ambient temperatures. (auth)

13296 (RN-S-0022) EVALUATION OF ANTICRITICALITY DESTRUCT SYSTEM. (Aerojet-General Corp., Azusa, Calif. (USA)). May 1964. 238p. Dep. NTIS $17.25.

Declassified 7 Sep 1973.

The selection of the Mark A configuration as the most promising, ejectable, explosive Anti-criticality Destruct System is described. A preliminary design of this system is presented indicating the proposed attachment to the NERVA engine structure. The Mark A configuration is comprised of linear-shaped charges arrayed about the pressure vessel and two conical-shaped charges located at the nozzle throat. Additionally, a selection of the most promising Postoperation Destruct Systems with a bifunctional capability of providing reactor flight safety prior to engine start-up is presented. This system consists of a number of core length explosive projectiles fired into the reactor core from launch tubes positioned forward of the reactor shield. (auth)

13297 (RN-S-0033) EVALUATION OF POST-OPERATIONAL DESTRUCT SYSTEM CONCEPTS. (Aerojet-General Corp., Azusa, Calif. (USA)). May 1964. 263p. Dep. NTIS $16.25.

Declassified 10 Sep 1973.

The tentatively established post-operation destruct core-fragmentation objective was to reduce the entire mass of fueled NERVA engine core elements to fragments not exceeding $1/32$ inch size prior to their reentry into the earth's atmosphere. Explosive techniques applied to this research and preliminary design effort have a long history of successful employment as a primary mode of destruct for both missiles and spacecraft. The advantages of explosive techniques over other destruct concepts include: high specific energy, rapid reaction time, controllability, and reliability. Transforming the entire mass of core material into aerosol-size particles is not within the present state-of-the-art of explosive application. However, a large percentage of conversion is possible if suitable explosive techniques are applied in an efficient, controlled manner. The major problems encountered in this explosive application are the complexity of the NERVA engine design and the energy-attenuation properties of the engine materials. The core pulverization achieved by an externally-placed explosive configuration is greatly influenced by the massive, layered structure surrounding the core; while the performance of an injected, internal explosive is affected by the complex, three-dimensional geometry of the fuel-element material surrounding the explosive detonation center. The Mark D PODS concept produced the best fragmentation test results of all concepts that were investigated to date. The best performance of any of the variations of the basic Mark D concepts tested was provided by a configuration consisting of approximately 340 lbs of high explosives contained in six 133mm-diameter full-core-length projectiles (Test PO-82). The total system weight, including extra radiation shielding and thermal conditioning devices, is estimated to be ~3500 lbs for this configuration. A conservative interpretation of the results of this test indicated that one-half of the crudely simulated core material could be reduced to fragments of less than $1/32$ inch. Although the results obtained thus far have not adequately achieved the fragment-size objective, the general trend of test data indicates a capability for systematically controlling the fragment-size distribution over a wide range of conditions. This implies an inherent capability for this concept to be modified to satisfy a broad-spectrum of less stringent objectives as might evolve from future changes in flight safety criteria, NERVA engine evolution, and operational flight modifications. (auth)

13298 (RN-S-0152) WEIGHT, PERFORMANCE, AND CLUSTERING FOR OPTIMIZATION OF COORDINATED ADVANCED NUCLEAR ENGINES. (Aerojet-General Corp., Sacramento, Calif. (USA)). Oct 1965. 210p. Dep. NTIS $13.50.

Declassified 10 Sep 1973.

Nuclear engines for space applications will become possible when a high thrust-to-weight ratio with high I_{sp} can be achieved. Two aspects of developing nuclear engines with this feasibility recommend themselves: The satisfactory optimization of performance and weight, combined with the possibility of clustering several of these optimized engines into a particular stage for a specific mission. Optimization will improve the nuclear engine's competitive position, while clustering of smaller engines may reduce the developmental time necessary for a flight-type system. The Nuclear Optimization Program consists of a digital code to calculate an array of engine designs including a minimum weight system. It further considers engine weight penalties as they pertain to clustered stages. Both problem areas are discussed in a limited fashion. (auth)

13299 (RN-TM-0574) XE COMMON RADIATION ANALYSIS MODEL. Wilcox, A. D.; Lindsey, B. A. (Aerojet-General Corp., Sacramento, Calif. (USA)). Nov 1968. 63p. Dep. NTIS $6.25.

Declassified 11 Sep 1973.

The Common Radiation Analysis Model (CRAM) for radiation analyses of the XE engine in the ETS-1 engine test compartment is described. Nuclear subsystem analytical models, materials compositions, and sources were supplied by WANL; the analytical models, materials compositions, and sources for the engine and engine test compartment were developed by Aerojet-General. This CRAM will apply to both the XE-Prime and the follow-on modified XE, since the modifications currently proposed will not significantly affect the radiation analysis. (auth)

13300 (SD-71-465-5(Vol. 3)(Ph. 3)) NUCLEAR FLIGHT SYSTEM DEFINITION STUDY. Phase III. Final Report. Volume III. Program Support Requirements. Antypas, W. G. (North American Rockwell Corp., Downey, Calif. (USA). Space Div.). Apr 1971. 511p. Dep. NTIS $28.75.

The program support requirements include pertinent aspects of (1) test programs, such as test requirements and definition, test hardware, reliability-oriented test relationships, alternate development test programs, and an integrated test plan, (2) manufacturing including alternate assembly techniques and flow sequences, yearly manufacturing rates, post manufacturing checkout, schedules, and preliminary manufacturing plan, (3) facilities requirements for manufacturing, development, cold flow and hot tests, and dynamic test, and an integrated facilities plan which incorporated recommended facilities, integrated facilities schedules, problem area, ROM facilities cost, and funding projection schedule, (4) supporting research and technology requirements in areas such as structures, nuclear radiation, propellant management, astrionics, and operations, and (5) program definition which consists of system and design engineering plan, pre-launch operations, earth launch, mission operations, logistics support, and integrated support requirements. Pre-launch operations dealt with RNS transportation to KSC and NRDS, whereas earth launch operations flow sequence reflects alternate RNS assembly, checkout, and launch modes. (auth)

13301 (TID/SNA-1747) LOCATION OF NERVA INSTRUMENTATION AND CONTROLS ELECTRONICS. (Aerojet-General Corp., Sacramento, Calif. (USA)). [nd]. 64p. Dep. NTIS $6.25.

A study was conducted to determine the preferred location of the NERVA Instrumentation and Controls components in the propulsion module. It was concluded that, although the minimum risk approach was to put all electronics on the run tank top, for only a moderate increase in risk all the electronics should be mounted in the vicinity of Station 0.0 (Configuration B_{12}). This is potentially the lowest weight system, and the range of uncertainty in predicting the advancement of the state-of-the-art in radiation hardened electronics is less than that for any of the other configurations. It is concluded that configuration B_{12} represents the best compromise between reliability difficulties and weight penalties. (auth)

13302 (TID/SNA-1869) REFLECTOR-NOZZLE DESIGN TRADE STUDY. Trade Study No. 780. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). [nd]. 27p. Dep. NTIS $4.50.

Several design concepts of the reflector-nozzle interface are developed and compared using a comparison matrix, failure mode analysis and reliability considerations. Other reports are used as supporting evidence. (LTN)

13303 (TID/SNA-1879) THRUST CHAMBER ASSEMBLY PHOTOGRAPHS. (Aerojet-General Corp., Sacramento, Calif. (USA)). [nd]. 97p. Dep. NTIS $8.00.

13304 (TID/SNA-2030) ENGINEERING OPERATIONS REPORT: BURST TESTING OF THE NERVA TURBOPUMP TURBINE ROTOR ASSEMBLY. Harris, C. L. (Aerojet Nuclear Systems Co., Sacramento, Calif. (USA)). Apr 1972. 35p. Dep. NTIS $4.75.

The exact solution of the structural integrity of complex turbomachinery rotor configurations is difficult to achieve due to the great complexity of the elastic and plastic analysis that would have to be performed. The accepted practice of determining the safety margin of complex configuration rotor discs is to compare the disc operating speed to the speed at which burst occurs. Fortunately, an empirical formula has been developed to calculate disc burst speed based on a purely elastic analysis of the stresses in the disc. Because the method is empirical, it is customary practice to spin test a fully machined rotor to determine the actual burst speed. The results of a spin-to-burst test of the NERVA Turbopump turbine rotor assembly are described. The predicted burst speed of 42100 rpm was exceeded on each attempt to achieve burst, indicating a conservative analysis. The experiments were halted when gross plastic deformation resulted in a severe out-of-balance condition that prohibited further increases in speed. Measurements of selected dimensions revealed that significant yielding had occurred in the bore of the second stage rotor, and in the labyrinth rub ring on the upstream side of the first stage rotor. No indications of cracking were found after complete dye penetrant inspection of both rotors. The test program was considered successful in that the predicted burst speed of 42100 rpm was exceeded by 3000 rpm without bursting or any evidence of cracking. (auth)

13305 (TID/SNA-2256) RADIATION EFFECTS. General. (Aerojet-General Corp., Sacramento, Calif. (USA)). 15 Sep 1963. 377p. Dep. NTIS $22.00.

Declassified 7 Sep 1973.

Extensive data are presented on radiation effects on reactor materials and reactor instrumentation, the NERVA radiation environment, radiation heating, neutron activation, nuclear facilities for radiation effects studies, dosimetry, and radiation environment in space. An extensive bibliography is included. (LTN)

13306 (TID/SNA-2281) U-TUBE NOZZLE TEST PLAN. Kawashige, C. M. (Aerojet-General Corp., Sacramento, Calif. (USA)). 3 Mar 1964. 16p. Dep. NTIS $4.00.

Declassified 12 Sep 1973.

The nozzles to be tested are CRES 347 stainless steel jackets with CRES 347 U-shaped tubes brazed in place. Simulation firing with LO_2/LH_2 will be conducted to duplicate or exceed nuclear reactor firing conditions as part of the development program. These steel-jacketed nozzles are similar in configuration and operational concept to the aluminum-jacketed NRX-A nozzles but possess inherent advantages in fabrication and structural integrity. Injectors are defined and will be used to introduce LO_2/LH_2 into the nozzle chamber to simulate nuclear reactor operation with respect to temperatures and pressures. A nozzle to injector adapter will be used to receive design hydrogen flow rates from the nozzle coolant tubes and allow only the portion needed for combustion with LO_2 to simulate reactor conditions to flow into the injector. The excess LH_2 is diverted into the overboard dump system. The objectives of these nozzle tests are to: Demonstrate the structural integrity of the nozzle, determine the operational characteristics, provide data for heat transfer analysis, determine the flow distribution of the fuel through the coolant circuit, and qualify the nozzles for further testing. (auth)

13307 (TID/SNA-2289) NERVA ENGINE EXPLOSIVE DESTRUCT SYSTEM, SUBTASK 1.6. Monthly Progress Report for October 1963. (Aerojet-General Corp., Downey, Calif. (USA)). [nd]. 21p. Dep. NTIS $4.25.

Declassified 12 Sep 1973.

The objectives of this program are to design, fabricate, test, and evaluate a postoperational safety subsystem, having bifunctional capability, that is capable of being integrated into the NERVA engine complex. During the anticriticality phase of operation, this explosive destruct system must be capable of dividing the reactor core into subcritical fragments and of dispersing these fragments into a pattern such that a critical nuclear mass relationship cannot form when immersed in a moderating environment such as water. During the postoperational phase, this explosive destruct system must be capable of ensuring that no dangerous accumulation of radioactive particles generated during engine operation falls on populated areas of the earth's surface. This tentative objective establishes that the entire mass of fueled elements comprising the NERVA core must be fragmented into sizes less than 1/32 in. Fragmentation research and explosive performance studies in support of this objective are outlined. (auth)

13308 (TID/SNA-2293) REACTOR BACKUP NOZZLE, S/N 0000002L, TEST SERIES 3.4-02-NNN. Final Test Report. Kawashige, C. M. (Aerojet-General Corp., Sacramento, Calif. (USA)). [nd]. 22p. Dep. NTIS $4.25.

Declassified 12 Sep 1973.

Test firing of the Reactor Backup Nozzle was conducted 29 June 1963 on Test Stand C-6. The test series was concluded after one run of 7.808 seconds duration at 2.38 M. R. and 400 psia chamber pressure due to the discovery of a crack between 27 bolt holes in the aluminum pressure vessel support flange during disassembly for injector exchange necessitated by faceplate erosion. Analysis of the flange indicates that failure was caused by stresses induced by the temperature distribution and thermal gradients in the flange which were generated by the LH_2 flow during the test. No prechilling of the nozzle was conducted prior to the test. (auth)

13309 (TID/SNA-3013) SIMPLIFIED PRE-PDR TECHNIQUES FOR ASSESSING COMPONENT RELIABILITY. (Aerojet Nuclear Systems Co., Sacramento, Calif. (USA)). 12 Oct 1970. 35p. Dep. NTIS $4.75.

The increasing cost of developing new systems and the need to ensure the safe operation of a nuclear propulsion stage means there must be a very high chance for success before development can begin. This procedure specifies how to assess the chance for success (the reliability) during the preliminary design period. The need for doing a failure mode analysis prior to the assessment of reliability is explained. Apportionment of the allocated component reliability to the mode of failure level is illustrated. The three options for assessing the reliability at the mode of failure level are discussed. The option of analytical estimation by the stress-strength interference method is presented. Directions are given for the application of this technique during the pre-preliminary design review period. The procedure is written for the NERVA component design engineer who may have little experience with reliability or statistics. (auth)

13310 (TID/SNM-31) RESULTS OF BINDER SCREENING TESTS AND SELECTION OF TWO BINDER COMPOSITIONS. Swope, L. M. (Aerojet-General Corp., Sacramento, Calif. (USA)). 18 Oct 1971. 10p. Dep. NTIS $4.00.

Criteria are developed for screening and selecting binders for use in the fabrication of reinforced graphite composite materials (availability, uniformity of composition, re-use capability, handling characteristics, costs, radiation damage). Mechanical properties of specimens made with a number of different binders are presented and a rating system for choosing two of these binders for further development was developed. (LTN)

13311 (TID/SNM-50) SUMMARY OF NUCLEAR PROPULSION APPLICABILITY. [nd]. 44p. Dep. NTIS $5.25.

Both nuclear-rocket and nuclear-electric propulsion systems are versatile, but their versatility extends over different regimes of space missions, and their utilization with respect to launch vehicles involves different assembly operations in orbit. Consequently, the nature of the future space program and other space systems are major factors in determining whether they are competitive or complementary. Another consideration, is the difference in technological status. NERVA is already in the early stages of development, with the technology program completed and engine system definition nearly complete. By contrast, the nuclear-electric power source (a thermionic reactor is the best current candidate) has not yet reached readiness for technology development. Conclusions and recommendations are: (1) Advanced propulsion systems can reduce interplanetary trip times and transport heavier payloads for relatively-small increases in cost. This capability makes them cost-effective means of increasing information-return rate from planetary missions. (2) With low payloads, the choice of advanced-propulsion type (among chemical rockets, nuclear rockets and NEP) cannot be made solely on the basis of payload, cost and trip time. However, nuclear rockets provide significant cost and program advantages in second-generation missions with high payload and velocity requirements. NEP systems also excel in certain very-high-ΔV missions. (auth)

13312 (TID/SNM-51) NUCLEAR STAGE SYSTEM DEFINITION STUDY. Phase A. Fourth Monthly Letter Progress and Status Report, February 1 - February 29, 1972. (McDonnell Douglas Astronautics Co., Huntington Beach, Calif. (USA)). 14 Mar 1972. 32p. Dep. NTIS $4.75.

Efforts were concentrated on the definition of basic performance capabilities of various versions of a nuclear stage utilizing a small nuclear engine. The inert weights used were derived from preliminary MDAC stage scaling laws and engine characteristics furnished by LASL. Candidate nuclear stage concepts that would be responsive to various constraints were defined, e.g., cargo bay limitations, number of space shuttle launches, etc. Performance implications of utilizing slush hydrogen were investigated. Additional activities included analyses of alternate turbopump packaging concepts, with emphasis on shortening the engine length. Interface analysis efforts are summarized briefly. (auth)

13313 (TID/SNM-56) DESIGN AND SCALE MODEL TEST RESULTS OF A SEVERELY MODIFIED RAO CONTOUR NOZZLE. Coppo, R. H. (Sacramento State Coll., Calif. (USA)). 15 Nov 1971. 82p. Dep. NTIS $7.25.

Thesis.

The design, selection and scale model test results of a contour design for a convectively-cooled, ground test nozzle extension which originates at an area ratio of 5:1 (termination point of main nozzle) are described. Selection was based on the predicted ability of the contour design to duplicate the amount of heat transferred to the coolant (bulk temperature rise) of a reference Rao contour nozzle extension designed for flight conditions without inducement of flow separation at a chamber pressure of 450 psia. An 1/8 scale uncooled model was constructed using the selected contour (4° exit angle and 12:1 exit area ratio) with 40 pressure taps located along the divergent portion of the nozzle. Continuous wall pressure measurements were obtained up to a chamber pressure of 600 psia using nitrogen heated to 1500°R as the flowing fluid. Separation pressures as a function of chamber pressure were determined and compared with data of various authors. Agreement is shown in a few cases and the data refute the conclusion of several authors that separation pressure is equal to a constant times the ambient pressure. Pressure taps were located in all four quadrants to monitor any asymmetric flow separation; however, examination of the data did not reveal any such phenomenon. Based on examination of the data the selected contour incurred no flow separation at a chamber pressure of 450 psia and is capable of flowing full at an area ratio of 11.5 at a chamber pressure of 240 psia (55% of the rated chamber pressure of 450 psia) with only about a 3 degree deficiency in matching the bulk temperature rise of the reference nozzle extension. (auth)

13314 (TID/SNW-25) PRELIMINARY NRX-A1 ASSEMBLY PROCEDURES: COLD ASSEMBLY AT WANL. Zwillich, A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1 Feb 1963. 92p. Dep. NTIS $7.75.

Decalssified 7 Sep 1973.

13315 (TID/SNW-29) WANL INPUT TO THE SCN MILITARY APPLICATION STUDY. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1969. 53p. Dep. NTIS $5.75.

Declassified 7 Sep 1973.

Experience and engineering feasibility calculations are combined to project nuclear subsystem thrust/weight ratio and specific impulse, I_{sp}, to the year 2000. First, key characteristics of the NERVA engine are given. Then, a thrust/weight ratio is developed as a function of thrust by examining NRX-A6, R-1, NR-1 and a small engine design and showing that the ratio is higher for a high thrust. Possible methods of reducing weight are considered: Using flow control and reducing reflector thickness (and weight), shortening the reactor core, higher uranium 235 loading, power flattening, etc. Finally, the possibility of obtaining a higher thrust by attaining a higher fuel element operating temperature is considered. This involves the use of different fuel element materials (zirconium carbide, niobium carbide), minimization of channel deviations, higher power density, etc. (LTN)

13316 (TID/SNW-30) NRX-A3 STATUS REVIEW. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 11 Jun 1964. 83p. Dep. NTIS $7.25.

Declassified 7 Sep 1973.

13317 (TID/SNW-45) NRX INSTRUMENTATION AND CONTROL SYSTEM AT TEST CELL "A". (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Dec 1963. 80p. Dep. NTIS $7.00.

Declassified 7 Sep 1973.

The NRX reactor cold and hot runs are designed to test whether reactor components developed under the NERVA program can withstand the conditions imposed by a nuclear rocket engine. All tests will be performed at the Test Cell A complex at NRDS. The control and control-support systems at the test cell A complex are described. The major systems are: (1) drum control system, (2) nuclear instrumentation, (3) facility controls, (4) facility support systems, (5) data acquisition systems, and (6) criticality monitor and alarm system. (auth)

13318 (TID/SNW-72) TRADE STUDY FOR NERVA INTERNAL SHIELD DESIGN CONCEPTS. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). [nd]. 398p. Dep. NTIS $23.00.

Declassified 10 Sep 1973.

A Trade Study of concepts for the Internal Shield, a component of the NERVA Nuclear Subsystem, NSS, is presented. The purpose was to evaluate and select the most logical and reasonable approach for continued detail design and development consistent with the programmatic and technical requirements for the 10 hour full flow cycle engine as defined in the NERVA Program Requirements Document. The concepts evaluated were: Boron Carbide-Aluminum-Titanium Hydride (BATH) Shield; Borated Titanium Hydride (BTiH) Shield; Lead-Borated Titanium Hydride (Pb-BTiH) Shield; and Borated Stainless Steel-Borated Titanium Hydride (BSS-BTiH) Shield. The evaluation and selection was based on the construction of a comparison matrix. Each concept was evaluated against the requirements and the tentative selection was based on an objective approach which identifies the concept having the maximum likelihood of meeting the functional, technical and programmatic requirements. The BATH Shield is the concept selected and recommended for continued detail design and development. The major factors leading to this selection are described. (auth)

13319 (TID/SNW-74) XE-1 EXIT GAS THERMOCOUPLE ASSEMBLY DEVELOPMENT TEST. Salvador, L. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 24 May 1966. 17p. Dep. NTIS $4.00.

Declassified 7 Sep 1973.

The qualification testing of the XE-1 exit gas thermocouple assembly was accomplished with the successful completion of test HHT-4-23a. Previous tests, reported in detail in WANL-TME-1375, failed to qualify the NRX-A5 design, primarily because of severe corrosion of the extended pyrolytic graphite insulating cup. Several changes were, therefore, made in the XE-1 design based on the knowledge gathered from the previous tests. (auth)

13320 (WANL-PR(J)-033) NERVA NUCLEAR SUBSYSTEM. Progress Report, April 1, 1964-June 30, 1964. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 5 Aug 1964. 399p. Dep. NTIS $23.00.

Declassified 10 Sep 1973.

The NRX-A1 test assembly was dismantled, completely disassembled and post-operative inspections performed. The inspections found no evidence of flow-induced vibrations. From the NRX-A1 test data it was determined that no thermal or fluid flow problems constrain the planned operation of the NRX-A2 reactor. During all fast chilldowns with liquid and cold hydrogen, excessive torques were measured at the NRX-A1 control drums. Investigation discovered that transient temperature gradients bowed the drums, causing them to rub against the outer reflector sectors. A slight increase in the clearance between the drums and the sectors solves the problem, and the NRX-A2 sector bores were made larger. Inserting a pre-chill interval prior to the startup ramp will also alleviate the condition. The results of the full scale reactor vibration tests conducted in the previous quarter increased the confidence in the NRX-A design. The vibration test reactor was disassembled and inspected, and was then reassembled with additional components including outer reflector components. Further testing has begun. In other specialized investigations the Phase 1 low pressure and high pressure steady state flow tests of the plugged channel reactor were conducted. Analysis of the test data revealed no mechanical instabilities. The NRX Safety Analysis Report (SAR) was published. The report concludes that no NRX test operation creates any undue risk to on-site or off-site population. The NRX-A2 Safety Evaluation Report was also published; it concludes that all proposed NRX-A2 test operations satisfy the safety requirements of the NRX-SAR, and that the radiological consequences of normal or abnormal operation will not exceed the estimates made in the NRX-SAR. The pre-assembly experiment (PAX) in support of NRX-A2 was completed. Analysis of the experimental data confirmed previous measurements by LASL and varified WANL analytical interpretations of differences between the KIWI and NRX reactors. The experiment also provided the basic information for shimming and orificing the NRX-A2 reactor. The PAX reactor is being reassembled for further experimentation. The need for a proof test experiment (PTX) of the NRX-A2 reactor was reviewed and rejected. Assembly of the reactor was completed, the reactor was installed in its shipping container, mounted on a special flatcar, and shipped to NRDS. (auth)

13321 (WANL-PR(J)-035) NERVA NUCLEAR SUBSYSTEM. Summary Progress Report, October 1, 1963-September 30, 1964. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 23 Oct 1964. 104p. Dep. NTIS $8.25.

Declassified 10 Sep 1973.

Successful tests of the NRX-A1 and NRX-A2 reactors were the major accomplishments during the Contract Year. The cold flow tests of the NRX-A1 were performed during March and April, 1964; the nuclear power tests of the NRX-A2 took place in September 1964. The cold flow tests of the NRX-A1 were conducted in accordance with plan and performance was in accordance with prediction. There was no damage of a magnitude to require delay or termination of the tests. The minor hardware damage which did occur did not interfere with other hardware, nor did it introduce any undesirable stresses in the system. Additionally, there was no excessive vibration as had been experienced in the KIWI-B4A and KIWI-B4ACF test series. After successful preliminary fluid flow, nuclear, control and scaled down power checks, the NRX-A2 was successfully power tested. All test objectives were met. The steady-state design analysis for power operation was verified. Data on the reactor's operation at the steady-state power level and temperature was compiled and awaits more detailed study. The reactor's capability to start, operate at steady-state, and shut down using liquid hydrogen was also verified. Restart of the reactor was also successful. In the low-power, low-flow, mapping experiment a major milestone was accomplished when indications of two-phase flow entering the core were observed with the reactor demonstrating stability in the range tested. In addition, power control was demonstrated over a two-fold coolant flow range and position control demonstrated over a power level range from 20 to 55 megawatts. (auth)

13322 (WANL-PR(J)-042) NERVA NUCLEAR SUBSYSTEM. Progress Report, 1 April 1966-30 June 1966. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 25 Jul 1966. 189p. Dep. NTIS $12.50.

Declassified 11 Sep 1973.

On June 8, 1966 the NRX-A5 reactor operated successfully at full power for 15.8 minutes in Test Cell A at the Nevada Test Site and operating time was limited only by the liquid hydrogen storage capacity. This test employed, a no-flux loop temperature controller which demonstrated improved control performance with no sacrifice in stability margins. A second NRX-A5 operations test on June 23 demonstrated the capability of LH_2 flow control from low power start up to rated conditions; full power steady-state operation under the no-flux temperature control was then accomplished for 14.3 minutes at which time the reactor was smoothly shut down due to both the near depletion of test cell hydrogen and of nuclear reactivity of the reactor core. The NRX-A5 is now being disassembled for detailed examination of fuel element behavior. The NRX-A4/EST reactor, having under-

gone successful operational tests in March, was disassembled for examination. Although preliminary evaluation of fuel element behavior indicates considerable corrosion damage due to the reactivity changes encountered during the tests, the general condition of the outer reflector, control drums, and axial support system, was excellent. Construction of NRX-A6 components continues on schedule with the exception of certain critical items of hardware which are about four to six weeks behind schedule. XE-1 support block coating was completed for both regular and irregular blocks. Approximately 25 percent of the fuel elements have been released by the Astrofuel Facility. The outer reflector is 95 percent assembled. Defunction of XE-2 reactor internal instrumentation was completed. Shield and outer reflector instrumentation has been released for assembly. The simulated shield and thermal capsule assemblies have been completed and the outer reflector is 95 percent assembled. Preliminary reactivity estimates have been made to analyze the core fuel loading requirements. (auth)

13323 (WANL-TME-085) FAILURE MODE ANALYSIS SUMMARY: NERVA NRX-A REACTOR. King, T. L.; Neal, R. A.; Spezialetti, I. R.; Wandell, G. F. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 25 Mar 1963. 89p. Dep. NTIS $7.50.

Declassified 10 Sep 1973.

A Failure Mode Analysis of the NERVA NRX-A Reactor Design has been made. The results are summarized with emphasis on recommendations to improve the overall reliability of the reactor. This analysis pertains to the NRX-A configuration as of November 1962. (auth)

13324 (WANL-TME-111) TEST CELL A GAS STORAGE REQUIREMENTS. Poindexter, A. M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 29 Aug 1962. 2p. Dep. NTIS $4.00.

Gas storage requirements of hydrogen, helium and nitrogen are estimated. (LTN)

13325 (WANL-TME-162) GAMMA RAY SOURCE STRENGTH FOR EQUIVALENT POINT SOURCE. Svasek, A. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 11 Oct 1962. 3p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

The point source gamma ray strength equivalent to 60 NRX fuel elements, which had been operated in a NERVA reactor for 20 minutes at full power and aged 1 week, is calculated. Values are given for nine energy ranges. The information is required for the design of shielding doors of the transfer car system in the E-MAD facility. (LTN)

13326 (WANL-TME-202) DRAFT SAFETY REPORT FOR SHIPPING NERVA REACTORS. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Nov 1962. 45p. Dep. NTIS $5.25.

Declassified 10 Sep 1973.

The safety precautions taken to protect against hazards resulting from the shipment of NERVA core and reactor assemblies are described. It is planned to assemble the NERVA reactor, which includes the fuel elements, the graphite reflector barrel, the beryllium reflector and control drums, and the top support plate at Large, Pa. The assembled reactor will be loaded into the shipping container and shipped by truck to Waltz Mills, Pa. After a set of proof test critical experiments, it will be returned by truck to WANL and subsequently loaded on a flat car for rail shipment to Las Vegas, Nevada. The last part of the trip will be by truck from Las Vegas to the Nevada Test Site. Shipment by rail will make use of a special train. Shipments by truck will be escorted. Measures have been taken to prevent accidental criticality during shipment or as a result of an accident involving this shipment. A nuclear poison system will be installed in the core during shipment to insure safety following any event which could have introduced moderating materials into the core. Standard precautions against radiation hazards will be taken. (auth)

13327 (WANL-TME-323) SHIPPING CONTAINER NRX-A ASSEMBLED REACTOR. Price, J. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 22 Apr 1963. 30p. Dep. NTIS $4.50.

Declassified 11 Sep 1973.

13328 (WANL-TME-325) NRX-A REACTOR DESCRIPTION. Oral Presentation at WANL, March 19, 1963. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 19 Mar 1963. 84p. Dep NTIS $7.25.

Declassified 11 Sep 1973.

At a design review meeting, recent changes in NRX-A2 design were explained. The changes involved (1) less in-leakage to avoid thermal shock and corrosion, and (2) limitation of self-excited vibrations. Planning and scheduling are discussed, particularly with respect to mechanical and flow testing and the tentative selection of dates for freezing design (after which changes will cause program slippage). Various tests of tentative design features are discussed in some detail. (LTN)

13329 (WANL-TME-328) SPECIFICATION OF A BACK-UP FUEL FOR NRX-A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). May 1963. 42p. Dep. NTIS $5.25.

Declassified 11 Sep 1973.

The central zone loading specification for an oxide fueled core that could be used as a backup to the present NRX-A-2 beaded fuel core is established. The major difference between this requirement and that for the beaded core is in the uncertainty associated with the fabrication of the fuel elements. Based on the present experience with KIWI fuel elements, it was possible to reduce the negative uncertainty by about $1.0. The graphite density of the oxide fuel elements is lower than that in the beaded fuel element. Therefore, it would be necessary to employ a uranium central loading of 441 mg/cc if the 98 mil reamed channel used in the beaded fuel elements is maintained. Hydraulic analysis of an oxide core with a reamed hole of 96 mils and lined over only the exit 36" yields a pressure drop essentially identical to the fully lined 98 mil reamed beaded fuel channel. For this reason, the 96 mil hole size and a 420 mg/cc fuel loading are specified for the central zone of the oxide core. (auth)

13330 (WANL-TME-330) STATUS REPORT OF ANALYSIS OF THE KIWI B-5 SHIELD MEASUREMENTS AT LOS ALAMOS. Woodsum, H. C.; Stephenson, L. D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Apr 1963. 44p. Dep. NTIS $5.25.

Declassified 11 Sep 1973.

Measurements made at the Los Alamos Scientific Laboratory on the ZEPO assembly with KIWI B-4 reactor mockup, and Westinghouse B-5 shield are reported and compared with calculations. Some difficulties were experienced in the early part of the experimental program in reducing the scattered radiation background to negligible levels compared with the direct radiation. After suitable collimators were devised, the measured shield attenuation agreed quite well with the calculations. The measured and calculated doses are also in reasonable agreement. Based on the experimental measurements, the centerline attenuation of the B-5 shield appears to be 18 ± 2 for gammas and 125 ± 50 for neutrons while point kernel calculations predict 20 and 140 for gammas and neutrons respectively. Comparison of diffusion and transport theory calculations through the shield centerline with experimental activation measurements with Cd covered U^{235} foils, shows that multigroup or few group diffusion theory grossly over predicts the shield attenuation while few group transport theory calculations agree fairly closely with the measurements. (auth)

13331 (WANL-TME-355) PRE-ASSEMBLY EXPERIMENT (PAX) EXPERIMENTAL PLAN FOR NRX-A-2. Freidhof, W. E.; Barksdale, C. E.; Rothman, A. B.; Rankin, W. D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1963. 160p. Dep. NTIS $11.00.

Declassified 11 Sep 1973.

The primary purpose of the Pre-Assembly Experiments (PAX) is to establish the reactivity, power distribution and control worth of the NRX-A reactor, to shim it to the desired operating control drum position, and to obtain power distribution data necessary for orificing the core. Regardless of whether or not shim adjustments to the initial design loading are necessary, it would be advantageous also to determine as much about the effect of shim elements on the reactivity, control drum worth and power distribution of NRX-A as time permits. In addition, experiments will be conducted in PAX to determine the reactivity worth of the poison shipping wires which will be used to ensure the safe assembly and shipping of NRX-A. To achieve these goals, a planned experimental program has been established along with an approved procedure for conducting the experiments. The primary purpose is to present the detailed steps that will be used in conducting the experiments to give the WANL Nuclear Safety Committee sufficient detail on the mode of operation to allow assessment of the hazards. Secondly, the procedures provide the detailed guidance and orientation to the newly organized operating staff during a period of initial experimentation. (auth)

13332 (WANL-TME-355(Suppl.1)) EXPERIMENTAL PLAN FOR NRX-A. Wright, J. B.; Barksdale, C. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Mar 1964. 86p. Dep. NTIS $7.50.

Declassified 11 Sep 1973.

The planned Proof Test Experiment (PTX) on NRX-A consists of a series of nuclear measurements on the fully assembled core

prior to "Hot-Testing" at the Nevada Test Site. An effort will be made to simulate conditions, from a nuclear standpoint, existing on the test cart at NRDS prior to hydrogen introduction. The only differences will be simulated pressure vessel, dome end closure, nozzle, and the general environment exterior to the pressure vessel. The purpose of this series of experiments is to determine and, if necessary, provide the basis for correction of nuclear parameters of NRX-A which have a bearing on the success of the hot test. Of prime importance are such items as "cold critical" control drum positions, control drum worth in reactivity, and core power distribution. Prior to the assembly of NRX-A and this series of tests, a Pre-Assembly Experiment (PAX) will be performed on NRX-A type components which will provide data necessary for reactivity and power distribution adjustments. The PAX and extensive analytical analysis will help determine the NRX-A design and the PTX, if performed, will serve as a verification on these important nuclear parameters. The plans for the experiment are detailed. (auth)

13333 (WANL-TME-365) NRX-A CORE ECCENTRICITY. Downs, G. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 6 Jun 1963. 11p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

An analysis of the possible eccentricity of the NRX-A core considered as a solid cylinder located within another cylinder by preloaded radial springs is presented. The core may be displaced off center with respect to the Inner Reflector by a lateral force on the core. When this force is removed, the spring system is unbalanced and tends to move the core back toward center. The frictional force of the system will oppose this movement and the unbalanced force in the spring system will be overcome by the frictional force before movement ceases. Using the derived expression and an arbitrary coefficient of friction of .25, the core is found to come to rest .0796 inch eccentric to the inner reflector when the lateral load is slowly removed. When the lateral load is suddenly released, the unbalanced force on the system will set up a free vibration with couloumb damping. The eccentricity of the core with respect to the inner reflector, when motion ceases, is dependent upon the eccentricity at the time of sudden release of load but is never more than .0796 inches. The steady force required to move the core to its maximum displacement (.200 inch) is independent of the eccentricity, therefore, it is the same as required to move it from the centered position. The effect of the core tie rods on the lateral movement of the core is neglected. (auth)

13334 (WANL-TME-377) TRANSDUCER INFORMATION FOR G-1 REACTOR ASSEMBLY MECHANICAL TESTS. Igne, E. G.; Ettenson, N. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 24 Jul 1963. 40p. Dep. NTIS $5.00.

Declassified 11 Sep 1973.

The instrumentation to be used in the G-1 Reactor Assembly during the Mechanical Vibration Test Program is described. The test plan consists of a series of four tests: Core Assembly Vibration Tests, Integral Reactor Assembly Tests, Shock Tests, and Environmental Tests. A judicious placement of transducers is necessary to satisfy the objectives of defining the dynamic characteristics of the reactor components under external vibratory and shock excitation. Transducer locations and types for the ND-201 vibration reactor were defined in advance of those used in the NRX-A1 cold flow reactor. However, every effort has been made to gain compatability wherever possible. Core fuel elements and filler strips have been instrumented according to the NRX-A1 plan. Since a more comprehensive instrumentation plan was required in the G-1 test, fuel clusters and filler strips with more detailed strain transducer coverage were included. Additional instrumentation was also applied to the inner reflector, core support plate, support blocks and tie rods. Modifications of transducer types used for the vibration reactors will take place as candidate transducers for the cold and hot test reactors become fully defined. Significant components to be instrumented are shown. Specification sheets for each transducer are included. These transducers will measure accelerations, velocities, relative displacements and strains. (auth)

13335 (WANL-TME-424) STATUS OF NRX-A DESIGN. Arnold, W. H. Jr. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 5 Jul 1963. 6p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

Comments on the NRX-A reactor design were made in preparation for a design review meeting. At this time, failure by mechanical vibration like KIWI-B4A was still considered a possibility but design changes had been made which might prevent such vibrations. Various other stress analyses, thermal analyses and fluid flow analyses are referred to, especially with respect to fuel elements and their adequacy, and also core supports. (LTN)

13336 (WANL-TME-427) GAP MEASUREMENT BETWEEN ELEMENTS OF A NINE-INCH CORE. Appleman, R. H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 Jul 1963. 15p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

Part of an overall effort to determine the size of gaps which exist between elements in a reactor core built to current specifications and assembled in a normal (not selective) manner is reported. Included are a listing of "across flats" hex dimensional data for two sectors of the core, gap measurements between elements in a 9-inch core, diameter variation of a full-length core as bundling pressure is increased, and the influence of various vibrational level loadings upon gap sized. (auth)

13337 (WANL-TME-431) EVALUATION OF FLEXIBLE CRITICAL EXPERIMENTS IN THE NERVA PROGRAM. Gallagher, J. G. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 10 Jul 1963. 28p. Dep. NTIS $4.50.

Declassified 10 Sep 1973.

At the request of SNPO, a comparative evaluation of the KAPL PPA Critical Assembly and the proposed WANL Flexible Critical Assembly (FCX) has been made in connection with the NERVA reactor physics problems to be solved. Even at extra cost the FCX assembly is recommended because of the difference in fuel materials (self-shielding corrections are required with PPA) and the particular problems to be resolved (which require precise measurements of reactivity, reactivity changes with temperature, power distribution, etc.). An integrated program of critical experiments and analysis with geometries, materials and fuels very similar to the NERVA design is required for the attainment of the required measurement precision. (LTN)

13338 (WANL-TME-438) SPECIFICATIONS AND DRAWINGS FOR CORE ELEMENTS: WANL NRX-A1 COLD FLOW TEST. Fields, C. C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 Nov 1963. 85p. Dep. NTIS $7.25.

Declassified 10 Sep 1973.

13339 (WANL-TME-485) EFFECTS OF LATERAL SUPPORT ABNORMALITIES AND CORE INLET BAND ON THE VIBRATION CHARACTERISTICS OF NRX-A1. Blake, P. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 16 Aug 1963. 18p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

Analog computer results with mathematical models show that clamping the core inlet will prevent vibrations which could have existed in an unclamped core. Such vibrations arise from abnormal conditions such as excessive leakage through the seals or loss of lateral support spring forces. No vibrations of the clamped core have been found, regardless of abnormality. A brief survey of possible abnormal NRX core conditions, revealed significant vibratory tendencies for the unbanded (unclamped) core. It is reasonable to expect many more possible abnormal conditions which will cause the unbanded core to vibrate. Under the same abnormalities investigated for the unclamped or unbanded core, the banded core did not vibrate for any of the conditions. The KIWI-B4A design vibrates even with a band. Thus, banding alone does not prevent vibration. The other features of NRX must also be present along with the band (Lateral seal leakage and lateral spring characteristics). The basic soundness of the inlet end band is supported by the observation that vibrations which could be excited in unbanded cores with defective lateral supports were all stopped by banding the inlet, and that no vibratory situation was found for the banded inlet case. (auth)

13340 (WANL-TME-496) STRESS ANALYSIS; NRX-A OUTER REFLECTOR ASSEMBLY. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1963. 20p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

The analyses performed to evaluate the full power, steady-state stresses and deflections in the NRX-A Outer Reflector Assembly are reported. All of the outer reflector components, except locking devices and bearings, were analyzed. Distortion energy was used as a basis for design of the ductile materials. The allowable stresses and the criteria on which they were based are presented. (auth)

13341 (WANL-TME-519) TEST REPORT ON PRELIMINARY VIBRATION DATA BASED ON TWO SINGLE ELEMENT TEST CONFIGURATIONS. Cherish, P.; Jacob, W. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). [nd]. 24p. Dep. NTIS $4.25.

Declassified 11 Sep 1973.

Preliminary vibration data were obtained from various tests conducted with two different types of single element test rigs to determine the behavior of the element when subjected to internal and external flow conditions. The results from the graphite fuel element tests or internal flow tests, showed no apparent flow induced vibration at the various pressure ratios tested. In general, the damping characteristics of an externally excited element was the same for helium flow as it was for air flow. However, the rate of decay of oscillation was less for helium than for air. The results from the simulated single element-tie rod tests, or external flow tests, showed that vibration at various frequencies could be induced by external flow around the element. The frequencies induced were found to be a function of mass flow, pressure ratio, and rod-tube clearance. An evaluation of the results from both tests established confidence that the behavior of a fuel element is substantially the same whether plugged or unplugged when subjected to gas flow conditions. (auth)

13342 (WANL-TME-534) DETAILED MODEL STATUS REPORT. Blake, P. J.; Hafer, J. F.; Steiner, G. H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 25 Sep 1963. 90p. Dep. NTIS $7.50.

Declassified 11 Sep 1973.

The present state of analog engine models is presented. Each major component or system is discussed. The engine analog simulation has been used in the design of a reference reactor power control system which established a basis for early hardware development. A breadboard reactor power controller was then tied into the analog simulation to verify its equivalence to the analog design. Besides providing a tool for reactor controller design the engine simulation was used to study the combined operation of the turbopump and reactor to search for potential problem areas. (auth)

13343 (WANL-TME-547) NERVA FUEL EVALUATION AND DEVELOPMENT PROGRAM, CY 1964. Boltax, A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 30 Sep 1963. 52p. Dep. NTIS $5.75.

Declassified 11 Sep 1973.

The reference fuel material for the NERVA-NRX-A series of reactors, designed for nuclear rocket engines, consists of a dispersion of pyrocarbon-coated uranium dicarbide particles in a graphite matrix. The fuel element is hexagonal in cross-section, 52 inches long, and contains 19 axial coolant holes coated with 1-2 mils of vapor deposited NbC. Fuel elements of this type are designed to operate at high power densities in high pressure flowing hydrogen at maximum temperatures in excess of 2400°C. Although the technology of graphite matrix fuel elements has been adequately demonstrated, additional technological advancements are required before the present goals of the NERVA rocket engines can be achieved. The principal problems involve fuel element processing and behavior of fuel elements in the high temperature hydrogen environment. The need for considerable effort in the area of fuel evaluation and development was recognized and initial studies, primarily in the evaluation of fuel material properties and corrosion behavior, have been augmented to include more detailed evaluation studies and fuel development activities. Fuel evaluation and development activities initiated are: measurement of physical properties (thermal expansion, thermal conductivity); measurement of mechanical properties (flexure, compressive and tensile strengths as a function of fuel loading, manufacturing variables, etc.); mechanical proof tests; hydrogen corrosion studies; hydrolysis; high temperature behavior; x-ray studies; thermal stresses; irradiation effects; coated particles; niobium carbide coatings; etc. (auth)

13344 (WANL-TME-596) SUPPORT BLOCK AND TIE ROD INTERACTION FLOW TESTS WITH TRANSPARENT PLEXIGLAS MODEL. Burghardt, R. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 11 Nov 1963. 9p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

The bottom support block and tie rod are part of a complex structural system which retains all of the fuel elements in the core. Optimization of these critical items is required in order to insure a successful power run on the NRX-A designs. The purpose of the support block flow tests is to determine the interrelation of the tie rod support system with the unfueled center element in order that their structural integrity be assured under operating conditions. A plexiglas model which essentially duplicated the geometry of the bottom support block in the immediate vicinity of the tie rod support cone was used to obtain preliminary information on the flow patterns at the exit of the tie rod channel. Water was used in place of hydrogen, with hot water simulating the tie rod channel flow and cold water simulating the fuel element channel flow. The position of the tie rod support cone was varied over a range above and below the original design location and measurements were made on the temperatures of the tie rod tip, the tie rod channel flow, and the fuel element channel flow. It was concluded that the tie rod tip would obtain maximum cooling if it were recessed approximately 0.2 inches below the face of the support block. (auth)

13345 (WANL-TME-616) NRX-B CORE CAGE REACTOR, MECHANICAL DESIGN. Cooper, L. H.; Eggers, A. G.; Turner, W. C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 16 Dec 1963. 97p. Dep. NTIS $8.00.

Declassified 10 Sep 1973.

Six design layouts are described, each defining a possible variation in the geometry of the core cage reactor arrangement. Four of the designs employ a single coolant pass through the metal structure and the other two designs use a two-pass system. Design variations using clusters of 19, 37 and 61 fuel elements are included. The method used to fabricate the core cage structure differs from design to design. The manufacturing aspects of the designs are discussed, and a stress analysis of the major mechanical components is included. (auth)

13346 (WANL-TME-638) SUMMARY OF NERVA INSTRUMENTATION REVIEW MEETING AT WANL, DECEMBER 17-19, 1963. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 2 Jan 1964. 313p. Dep. NTIS $18.75.

Declassified 29 Aug 1973.

The NRX-A-2 instrumentation requirements, the selected transducers, and the progress of the instrumentation development programs for radiation-resistant transducers were reviewed. Back-up facilities and programs available at NBS, LRC, LASL and Battelle were discussed. The purpose of the presentation was to review the work status on radiation-resistant instrumentation, to discuss the problem areas that have been uncovered, and to insure better communications at the working level between the various SNPO-sponsored activities. (auth)

13347 (WANL-TME-656) COMPONENT TEST A-11. Phase II. Flow Induced Vibration Test. Cherish, P.; Leff, G. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 16 Jan 1964. 48p. Dep. NTIS $5.50.

Declassified 12 Sep 1973.

A seven cluster core which simulated the basic design features of the NRX-A reactor was modified in an attempt to provide a dynamically unstable model by including some features which promote instability. This A-11, Phase II, seven cluster core configuration was flow tested over the range of 0.06 to 0.41 pps of hydrogen with core inlet pressures from 30 to 186 psia. Motion pictures taken at 250 frames per second of the nozzle end of the seven fuel clusters in conjunction with oscillograph traces from a displacement sensor mounted on one of the bottom support blocks showed that flow-induced vibrations did not occur during either transient or steady-state conditions. Interstitial pressure data and core longitudinal pressure distribution data for the lateral support and seal system were obtained at various test conditions. (auth)

13348 (WANL-TME-661) EVALUATION OF NRX-A2 CRITICAL EXPERIMENT SCHEDULE ALTERNATES. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1964. 43p. Dep. NTIS $5.25.

Declassified 12 Sep 1973.

The factors influencing the scheduling of NRX-A2 critical experiments are reviewed. These factors include fuel element availability, design and safety data requirements, and radiation levels from components following the experiments. Various combinations of pre-assembly experiments and proof-test experiments are evaluated. The nuclear uncertainties associated with the various approaches are discussed and schedule recommendations are made. (auth)

13349 (WANL-TME-710) RADIATION EFFECTS DATA BOOK. Zorn, J. B. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1 Jul 1964. 241p. Dep. NTIS $15.25.

This Radiation Effects Data Book deals primarily with the instruments, mechanical components and materials associated with the NERVA Reactor Subsystem. It provides an assessment of the various component designs and material selections with respect to their capability for withstanding the combined radiation and non-nuclear environment expected in NERVA. It also serves to consolidate under one cover the salient features of all radiation effects tests performed by WANL. (auth)

13350 (WANL-TME-724) LEAKAGE FLOW OF PLUGGED-ORIFICE GRAPHITE FUEL ELEMENTS AT REACTOR OPERATING PRESSURES. Schulman, E. H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 20 Mar 1964. 32p. Dep. NTIS $4.75.

Declassified 11 Sep 1973.

Leakage flow rates occurring through the end faces of plugged-orifice graphite fuel elements, were estimated to be of the order of 6.84×10^{-5} lbs/sec to 76.0×10^{-5} lbs/sec. These leakage flows would occur at the following operating conditions: Inlet core pressure = 750 psia, exit core pressure = 620 psia, ambient temperature, and inlet inner reflector mass flow rate = $\frac{1}{2}$ lb/sec. These pressure conditions will not be exceeded during the ND207 tests. Based on inner reflector mass flow, leak rates are estimated to be from 0.014% to 0.15% of ND 207 reactor flow. (auth)

13351 (WANL-TME-729) NRX-A2 CONFIGURATION FOR RADIATION ANALYSIS. Capo, M. A.; Nassano, R. N.; Soltesz, R. G. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Mar 1964. 72p. Dep. NTIS $6.75.

Declassified 11 Sep 1973.

13352 (WANL-TME-786) TEST REPORT ON A WANL RADIATION TEST OF NERVA COMPONENTS (GTR TEST 9). (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 20 May 1964. 57p. Dep. NTIS $6.00.

Declassified 11 Sep 1973.

Several different types of instrumentation and control drum actuator components were irradiated at the GTR reactor in September and October, 1963. A total integrated power of 300 megawatt hours was obtained during the irradiation. A brief description of each test is given. (auth)

13353 (WANL-TME-796(Vol.1)) WANL SOURCE TERM PROGRAM STATUS REPORT. Volume I of II. Brown, W. S. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). May 1964. 95p. Dep. NTIS $7.75.

Declassified 10 Sep 1973.

The WANL Source Term Program is part of the overall safety effort to define hazards associated with space nuclear propulsion. The analytical and experimental studies performed to date in the areas of fission product diffusion from NERVA fuel, re-entry burn-up, neutron activation of NERVA structural components, and chemical destruct are described. The following conclusions are drawn: The greatest radiological hazards associated with the re-entry of a reactor or of reactor debris arise from the fission products generated during reactor operation. Activity arising from neutron activation of reactor components is appreciably less than that due to the fission product inventory. Diffusion of fission products will reduce the inventory providing sufficiently high fuel temperatures are achieved. Post operational heating without coolant flow offers the most promising means of reducing the fission product inventory of the core prior to re-entry. Loss of fission products by diffusion during normal operation and during the re-entry of core fragments will not significantly reduce the fission product inventory. Re-entry burnup will not significantly reduce the source strength of nuclear debris. Chemical destruct experiments indicate that only potassium and chlorine trifluoride offer promise as destruct reagents. However, no definite conclusions regarding chemical destruct can be drawn at this time. (auth)

13354 (WANL-TME-815) CORE BAND ASSEMBLY TESTS, EML-7. Brickman, E. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep. 1964. 36p. Dep. NTIS $5.00.

Declassified 10 Sep 1973.

The core band assembly bundles the inlet end of the core and serves to minimize inter-element leakage and to reduce the possibility of inlet end fuel element vibration. A core band, assembled on a solid graphite core disk, was exposed to cryogenic (liquid nitrogen) temperatures and cycled between ambient and cryogenic temperatures four times with no loss in structural adequacy. The maximum stresses measured in the core band and its components at cryogenic temperatures were well within the elastic limit of the core band material. There was no measureable permanent set and no apparent loss in core bundling efficiency of the core band at the completion of the test. The measured stresses in the core band at assembly indicate that the actual preload achieved at ambient temperatures was less than was calculated. The results were further verified by the NRX-A1 cold flow tests. During disassembly of the NRX-A1 reactor assembly, it was noted that the core band had withstood the test with no apparent loss of core bundling preload. (auth)

13355 (WANL-TME-822) STRESS ANALYSIS: NRX-A2 DOME END SUPPORT RING. Pianka, E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1964. 15p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

The Dome End Support Ring is a titanium alloy structure used to mount the reactor in the pressure vessel and position it with respect to the pressure vessel and the exhaust nozzle. In the NRX-A1 reactor, a thin-walled, ring-stiffened cylinder was used for the support ring. However, in the NRX-A2 reactor the wall thickness has been increased and the stiffeners have been eliminated. The integrity of the revised support ring for the maximum loads anticipated during the NRX-A2 tests has been evaluated. It was determined that the ring can withstand a 190 psi radial buckling pressure, approximately six times the anticipated load. The peak stress which will be developed during maximum power, steady-state operation is 85,000 psi, a figure which compares favorably with the allowable limit of 109,000 psi. It is concluded that the configuration is acceptable for the NRX-A2 (partial power) and the NRX-A3 (full power) tests. (auth)

13356 (WANL-TME-837) SHORT GRAPHITE BARREL TEST. Final Report. Parsons, L. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1964. 14p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

The ability of the graphite barrel to withstand prolonged compressive stresses to 5000 psi was verified by testing a H4LM graphite ring. An aluminum ring, having an interference fit with the graphite ring O. D., was heated and allowed to cool on the graphite ring. The assembly was then cooled to −320°F to obtain a compressive stress of 5000 psi on the graphite ring I. D. An interference of 0.163 in. at room temperature provided a strain of 3900 μin./in. on the graphite ring I. D. at room temperature and 7500 μin./in. at −320°F. Since no failure tendency or damage was noted, it may be concluded that the graphite barrel can withstand comparable strains without incurring failure. (auth)

13357 (WANL-TME-838) EXPERIMENTAL TEMPERATURES OF AN NRX-A2 FUEL ELEMENT WITH A PLUGGED CHANNEL. Chi, J. W. H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 22 Jun 1964. 11p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

A fuel element with a plugged channel was environmentally tested in an attempt to determine the maximum internal-to-surface temperature gradient. For a five minute test with a flowrate and power input of 477 scfm and 942 kilowatts, respectively, it has been shown that the maximum internal-to-surface temperature gradient is 600°F with a possible error of ± 75°F. There was no apparent damage to the fuel element as a result of the thermal stresses. (auth)

13358 (WANL-TME-839) REVISED ANALOG COMPUTER MODEL OF THE NRX REACTOR. Buker, J. C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 18 Nov 1964. 62p. Dep. NTIS $6.25.

Declassified 10 Sep 1973.

A revision in the earlier analog computer model of the NRX system has been made in order to more accurately determine reactor control characteristics required by the in-core temperature control and safety-analysis studies. The major revisions include a three-channel reflector, a three-axial-section core and tie-rod model and the representation of more complete flow dynamics. The linear analysis of the heat transfer characteristics of the core, which led to the three-axial-section core, is presented. An outline of a program for future NRX and Engine model-development work is also given based on the experience gained with the new model and various anticipated future studies. (auth)

13359 (WANL-TME-850) NRX-A1 VIBRATION DATA ANALYSIS. Warner, P. C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1964. 16p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

In view of unexpected, large vibrations in previous KIWI reactor tests, elaborate instrumentation was set up to determine the dynamics of various critical parts of the NRX-A1 reactor, in particular the core, tie rods and core support plate. A great deal was learned about the characteristics of the data acquisition system, the play back systems, and the sensor system selection and installation, which will be of value in improving such systems. No large, low frequency vibrations were found, so there is no reason to expect possible dynamic stability problems or unexpectedly large exciting forces in the NRX-A1 cold flow tests. Some high frequency vibrations were identified but their level was not sufficiently high to cause concern. (LTN)

13360 (WANL-TME-853) STRUCTURAL EVALUATION OF NRX-A2 DOME END SUPPORT. Pianka, E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1964. 4p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

The results of a recent imploding pressure test of the unstiffened, thin-wall dome end support ring and design analysis calcu-

lations are compared: The maximum imploding pressure expected during the NRX-A2 test series is 34 psi, which occurs at the 100 percent power level. From the results obtained in the imploding pressure test of the thin-wall support ring, the expected buckling pressure of the NRX-A2 thick-wall ring will be greater than 190 psi and less than 355 psi. Therefore, the minimum safety factor is greater than five. (auth)

13361 (WANL-TME-854) EVALUATION OF NRX-A2 TIE RODS. Downs, G. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1964. 4p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

The results of experimental evaluations made to determine the adequacy of the NRX-A2 tie rods under combined bending and axial cyclic loading are summarized. The tie rod performed satisfactorily for loads greater than those anticipated during full-power, steady-state reactor operation. (auth)

13362 (WANL-TME-855) EVALUATION OF NRX-A2 INNER REFLECTOR. Downs, G. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1964. 6p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

The stress analysis and tests performed to demonstrate that the NRX-A2 inner reflector graphite cylinder can successfully withstand proposed test conditions are summarized. Based on the results of these tests, the inner reflector will perform satisfactorily for loads in excess of those anticipated during the NRX-A2 tests. (auth)

13363 (WANL-TME-856) EVALUATION OF NRX-A2 CORE INSULATION REGION. Swanson, J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1964. 4p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

Insulating tiles made of pyrolytic graphite are fitted closely to the irregular core periphery and held against the fuel elements of the NRX-A2 core filler strips. Calculations and test results are presented which show that the core lateral insulating tiles are structurally adequate under the most extreme temperature gradients anticipated in the NRX-A2 test. A tile held flat against the core by the lateral support pressure and subjected to a temperature gradient of 2,770°R will have a maximum stress of 5,180 psi compressive on the hot surface and tensile on the cold surface. The minimum tensile strength of pyrolytic graphite at the cold surface (1,500°R) is above 7,000 psi. The bowing of the tile tends to reduce this stress. During the core insulation assembly thermal test, tiles have been exposed to hot surface temperatures as high as 5,000°R and thermal gradients of as much as 2300°R across the tile with nc permanent bowing or physical change in the tiles. (auth)

13364 (WANL-TME-857) EVALUATION OF THE THERMAL STRESS CAPABILITY OF THE NRX-A2 CONTROL PLATE. Ulrich, J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1964. 6p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

The control plate material (boral) is Al $-^{10}$B, a 20-weight percent dispersion of boron-10 in a 99% pure aluminum matrix. The primary design requirement for the NRX-A2 application is that the boral have adequate yield and ductility properties at operating temperatures to withstand the severe thermal gradients imposed on the control plate. These gradients are, in some cases, as much as 280°R axially and 380°R circumferentially. The corresponding thermal stresses range from approximately 3,000 psi tension to 9,000 psi compression. It was concluded that the boral control plate does have sufficient strength and ductility to prevent cracking during engine operation. This was evidenced primarily by the fact that the rivet holes elongated without cracking at a temperature of 140°R. The tensile load in this case was much higher than the calculated value during actual reactor tests. The material yield strength was also found to be much greater than the anticipated thermal stresses during reactor operation. (auth)

13365 (WANL-TME-858) EVALUATION OF THE NRX-A2 OUTER REFLECTOR SECTOR. Eggers, A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1964. 8p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

Stress analyses performed on the NRX-A2 outer reflector sector and the experimental results justifying both the maximum stress level and the reduction in web thickness from that of NRX-A1 are summarized. The stresses considered are those produced by the tie bolts, the pressure load, the support ring reactions, and the temperature distribution. Run profiles (cold gas and liquid start-ups) have been examined to determine the worst time for each stress condition. A maximum transient tensile stress of 28,400 psi will be exerted on the NRX-A2 sector for the cold-gas start-up or 39,200 psi for the currently planned liquid start-up. The NRX-A1 sectors successfully withstood such stresses during 12 cryogenic tests. A transient thermal test of a small-scale specimen showed that beryllium can withstand thermal stresses (calculated elastically) in excess of 52,000 psi. A specimen did subsequently fail at a strain corresponding to a stress between 52,000 and 97,000 psi. The scale test program also evaluated the effect of reducing the web thickness by 25%. The thermal gradient changes were insignificant, and failure did not occur. (auth)

13366 (WANL-TME-903) FOIL TYPE INSULATING SLEEVE VIBRATION TEST. Final Report. Gesinski, L. T. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1964. 6p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

The present insulating sleeves, made of deposit-formed, pyrolytic graphite, have shown a tendency to spall under dynamic conditions. This spalling characteristic resulted in jamming and binding of the sleeves during disassembly after completion of the partial core vibration tests. A foil type, pyrolytic sleeve has recently been developed as a possible material replacement for the present deposit-formed sleeves. Qualitative inspections regarding the wear, spalling and galling were made after lateral excitation and again after axial excitation. There was no spalling or galling experienced by any of the various types of sleeves. However, the foil type and natural tapered sleeves exhibited better resistance to wear as compared to the regular deposit-formed sleeves. Visual inspection of the two sets of regular (NRX-A2) sleeves revealed some powdering of the graphite at the outer (O. D.) surfaces. There was no noticeable wear or damage to the foil type or tapered sleeves. (auth)

13367 (WANL-TME-929) DYNAMIC TESTS CONDUCTED ON THE SEVEN CLUSTER PARTIAL CORE. Final Report. Gesinski, L. T. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1964. 18p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

A seven cluster partial core assembly of unfueled elements was subjected to lateral and axial vibration as well as axial shock. The vibration tests were performed over a frequency range of 15 to 500 Hz at g levels from 1 to 5 g's, however amplification of test rig inputs produced accelerations as high as 20 g's at the support block with no detrimental effect. Results from these tests revealed only minor chipping at the mating surface of the support block and fuel element. Resonant conditions were found to exist at approximately 50 Hz for lateral inputs and at 70 Hz for axial vibration. Axial shock tests showed no detrimental effects from shock loads up to and including the 9.0 g input. The shock inputs were amplified however by the core assembly which experienced core accelerations as high as 16 g's. (auth)

13368 (WANL-TME-974) MEASUREMENTS REQUIRED OF THE ASSEMBLED NRX-A1 REACTOR WHEN REASSEMBLED FOR USE BY AGC IN CFDTS. Schlitt, W. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Oct 1964. 11p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

The NRX-A1 reactor which was subjected to a "Cold Flow" test in February, 1964, will be rebuilt and used in the Cold Flow Development Test Simulator. It is possible that before or during the proposed test, indications of reactor damage or malfunction may necessitate reactor dimensional inspections and checks. The measurements listed are proposed in order to provide relatively simple check measurements and eliminate the need for disassembly. Small or insignificant deviations from the outlined dimensions will indicate that the reactor is suitable for further testing, while changes that result in values beyond the listed tolerances indicate a need for engineering review as a prerequisite to further testing. (auth)

13369 (WANL-TME-975) THERMALLY INDUCED STRESSES IN INSULATING CUPS. Hengstenberg, T. F.; Kotulak, F. M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1964. 12p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

Tests were performed to verify the structural integrity of the pyrolytic graphite insulating cups when subjected to bending stresses resulting from thermal cycles simulating differential radial growth under full power, steady state, reactor loading conditions. No evidence of damage to the graphite parts was noted after they were subjected to the thermal cycling superimposed on a fixed axial preload of 750 lb. (auth)

13370 (WANL-TME-979) NRX-A2 VIBRATION SURVEY. Bove, G. M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1964. 13p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

A high vibration level was measured on the nozzle of the KIWI B4-D reactor during the hot test which may have been one factor contributing to the nozzle failure and leakage. Evaluation of vibration problems that may exist on the NRX-A2 reactor assembly system with the Aerojet U-Tube nozzle was believed necessary. In addition, it was advisable to determine whether vibration dampers were necessary to reduce the possibility of failure due to nozzle excitation. The vibration tests described were conducted to explore the resonant frequencies, the modes of vibration and amplification factors of the NRX-A2 nozzle, propellant line and pressure vessel assembly as assembled for hot test. The test indicated a nozzle resonance of 239 Hz to be the most significant mode. These mechanical test results were confirmed by the analysis of spectrum data of the NRX-A1 EP 1B, GH_2 run, which showed this to be a strongly excited mode under gas flow excitation. After analyzing the data, the concensus of opinion was that gas flow excited vibration at 239 Hz would not be harmful to the nozzle during the duration of the NRX-A2 run. The 239 Hz mode shape was determined easily by touch when dwelling at this frequency. The mode involved motion of quarters of the nozzle, with longitudinal nodal lines at the propellant line junction downward to the nozzle throat and at positions 90°, 180°, and 270° from this position. Since the magnification factor of 72 was quite high and since such large areas were involved, it was believed that gas forces would excite this mode. Many other resonant frequencies were evident. The most significant frequencies of these other modes were 171, 245, 319, 1012, 1070, 1350, and 1478 Hz. The resonant magnifications (Q) determined for selected resonances were all quite high. (auth)

13371 (WANL-TME-991) REACTOR SUPPORT SYSTEM, DYNAMIC TEST. Krebs, A. N.; Morgan, L. P. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1964. 10p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

A cyclic loading test of the reactor support system was conducted at cryogenic conditions to determine whether the system components could withstand the pressure pulsations that might occur during extended reactor operation at full power. The cyclic test load was applied at the center of the support plate and varied from 86.5 to 111.5% of the full power core pressure drop load with a frequency of 12.3 cps. The system components were subjected to about one million loading cycles throughout the test. No visible damage of any of the test components was observed during or after the completion of the test. Since the pressure pulsations simulated during the test were somewhat more severe than those expected during reactor operation, it is felt that no fatigue failures due to pressure pulsations should develop in the support system components during the NRX-A3 reactor tests. (auth)

13372 (WANL-TME-1014) COMPREHENSIVE TIME EVENT COLLATIONS FROM EP-IV NRX-A2 SANBORN RECORDS. Rovnak, J. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 22 Oct 1964. 14p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

Events of interest that occurred during NRX-A2 EP-IVA Test are reconstructed from test Sanborn charts. The only other source of information used was the facility cal-comp plots from which the position of vent valve AVV-2 was obtained (AVV-2 stem position was not available on the test cal-comp plots). A detailed chronology is presented including several tracings to illustrate pertinent events. (auth)

13373 (WANL-TME-1086) EXPERIMENTAL DETERMINATION OF ORIFICE COEFFICIENTS FOR PRODUCTION-TYPE FUEL ELEMENT ORIFICES. Test Series FFL-6. Chronis, W. C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 17 Mar 1965. 67p. Dep. NTIS $6.50.

Declassified 11 Sep 1973.

Results of a series of tests to determine loss coefficients for NRX-A3 type fuel element orifices are reported. Tests were conducted using hydrogen gas at an inlet pressure of 660 psig and cryogenic temperatures. Curves of loss coefficient versus Reynolds number are presented for each of the twelve sizes, ranging from 22.5 to 70 mil, as well as a graph of loss coefficient at design Reynolds number versus orifice diameter. The problem of orifice clogging due to trace contaminants in the hydrogen is discussed and a solution presented. (auth)

13374 (WANL-TME-1087) NOTES OF MONTHLY COMPONENT TEST PROGRAM REVIEW MEETING HELD WITH SNPO AT WANL ON JANUARY 7, 1965. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1965. 13p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

The component test program review meeting involved tests of coated fuel elements, fuel element corrosion tests, orifice calibration and testing, high temperature fuel element tests, fuel element shipping container tests, mechanical and fatigue tests, etc. Various graphite components (filler strips, supports, etc.) were load and corrosion tested. Tie rods were tested with respect to seal leakage and fatigue. Other miscellaneous test results are reported. (LTN)

13375 (WANL-TME-1211) NRX/A4 EST TEST PREDICTION REPORT. Howarth, W. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1965. 248p. Dep. NTIS $15.50.

Declassified 11 Sep 1973.

A series of performance tests will be performed on the NRX-A4/EST engine and reactor subsystem to provide significant development information on the test article assembly. Predictions for these tests are contained herein. These data can be compared to test data displayed on Sanborn recorders so that it is possible to judge during or after a test that the reactor has operated in a normal manner. In addition to predictions for normal reactor operation, predictions are given for power scram, fire and loss of flow emergencies. (auth)

13376 (WANL-TME-1252) NON-NUCLEAR EVALUATION TESTS ON THE SUPPORT BLOCK AND CLUSTER EXHAUST GAS THERMOCOUPLE DESIGNS FOR NRX APPLICATION. Rich, R. B. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 23 Aug 1965. 30p. Dep. NTIS $4.50.

Declassified 12 Sep 1973.

The design, development and testing of two similar thermocouples for measuring the support block and the cluster exhaust gas temperatures are discussed. The requirements are outlined and materials and construction problems are described. (auth)

13377 (WANL-TME-1262) DETAILED ANALOG MODELS STATUS REPORT. Buker, J. C.; Luffey, F. C.; Rovnak, J. A.; Stock, A. H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 17 Sep 1965. 115p. Dep. NTIS $8.75.

Declassified 12 Sep 1973.

A detailed description is presented of various analog computer models of the NERVA system developed during CY '65 for systems and control analysis work at WANL. These models were developed prior to the agreements between WANL and REON to use a Common Analog Model for all official predictions of test performance. However, the models described have been of considerable value in helping to assess the validity of several proposed versions of the Common Analog Model and will continue to be used for validation of proposed nuclear subsystem models. Included are detailed descriptions of the basic NERVA-I reactor and nozzle model, EST and TCA feedsystem models, one-console NERVA-I and NERVA-II models, and PCV-41 and PCV-18 emergency flow shutdown models. Also included is a description of the nuclear subsystem portion of the Common Analog Model II for the EST engine system. (auth)

13378 (WANL-TME-1335) NRX/EST CORROSION ANALYSIS AND END OF LIFE CRITERIA. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Dec 1965. 71p. Dep. NTIS $6.75.

Declassified 11 Sep 1973.

Based on estimates of corrosion of fuel elements and support blocks, it is inferred that the NRX-A4-EST reactor will survive the planned testing with a weight loss per fuel element of 15 g and a slight reduction in fuel element strength and support block load carrying ability. This estimate is made with some qualifications and reservations. It is suggested that better estimates of a near end of life should be developed from diagnostic measurements (thermocouple readings), post test cold critical drum angle measurements, television observations of core exit, spectrographic readings of flame, fallout measurements, etc. (LTN)

13379 (WANL-TME-1389) NRX-A5 REACTOR ANALYSIS DATA. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 Apr 1966. 407p. Dep. NTIS $23.50.

Declassified 10 Sep 1973.

Reactor design goals, limitations and nuclear, thermal, radiation and corrosion data for the NRX-A5 reactor are presented. (auth)

13380 (WANL-TME-1414) NR-1 REACTOR. Interim Report on Beryllium Ring Design. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Apr 1966. 50p. Dep. NTIS $5.50.

Declassified 10 Sep 1973.

The NR-1 reactor design is based upon a reflector fabricated from three beryllium rings. Coil springs for lateral support are contained in the beryllium and bundle the core periphery through 24 sets of angle-faced, double acting, graphite seal rings. One seal ring in each set seals to the core periphery while the second ring seals to the reflector inner diameter. The design also features counterflow tie tubes supporting the core with their own separate feed system and an aft end axial support for the reactor structure. The reactor is supported on the forward end of the nozzle chamber. The reflector in this design is also used as a radial flow barrier for the reactor coolant, as a structural component in the axial support system, and as a structural component for the lateral support and distributed seal system. Combining these features in the reflector eliminates the graphite lateral support cylinder used in the NRX-A reactors and results in a considerable reduction in overall size and weight for an NR-1 size reactor and a simplified design. Mechanical, thermal and fluid flow properties of the reflector are considered in detail. (auth)

13381 (WANL-TME-1415) PRELIMINARY NRX-A5 COMMON ANALOG COMPUTER MODEL EQUATIONS. Luffey, F. C.; Buker, J. C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Mar 1966. 28p. Dep. NTIS $4.50.

Declassified 10 Sep 1973.

A set of equations agreed to by WANL and AGC (REON) is presented for use as a preliminary common analog computer model of the NRX-A5 reactor, nozzle, and feedsystem. The reactor and feedsystem equations were developed by WANL; the nozzle equations by REON. In the NRX-A5 test series, reactor-only type testing will be performed. The liquid hydrogen coolant will be provided by a facility turbopump system which derives its pumping power from high pressure ambient gas stored in the facility. To represent the feedsystem, the model previously used was updated to represent the NRX-A5 configuration, the new turbopump package and recent piping modifications made at the NRDS Test Site. The reactor and nozzle models are essentially those used in the CAM-IIC model for NRX/EST. The reactor, nozzle, and feedsystem equations are regarded as preliminary, in that modifications are anticipated in light of new information presently being obtained from post-test analysis of the NRX/EST test data. (auth)

13382 (WANL-TME-1430) EXPERIMENTAL INVESTIGATION OF INTERSTITIAL CORROSION FOR AN ISOTHERMAL MODEL PHASE I. Steffen, R. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). May 1966. 142p. Dep. NTIS $10.25.

Declassified 10 Sep 1973.

A test rig has been designed and fabricated to supply information on graphite corrosion in narrow slots. The test section is an axially split graphite cylinder containing a gap that is varied in thickness from 0.001 inches to 0.006 inches, the width of the slot is 1 inch, its length 2 inches. All the support hardware is fabricated of molybdenum to eliminate the generation of extraneous hydrocarbons which has been a serious problem in past designs. The tests, involving gaps of 0.006, 0.004, 0.002 and 0.001 inches in thickness, were conducted at 3500°R for 30 minutes with hydrogen flows of 0.0001 lb/sec. The inlet pressure levels were maintained at 200 psig. Post-test examination showed corrosion for the full length of the slot, decreasing toward the exit of the slot. Photos and surface regression data are included for general information. The test series is designed to independently show the effects of the parameters controlling this reaction and to what degree each exercises its influence. A second series of tests was initiated to demonstrate the effectiveness of various surface coatings as corrosion inhibitors. All these fixtures were tested at 3500°R for 30 minutes with hydrogen flows approaching 0.0001 lb/sec at 200 psig inlet pressure. Surface regression data, coating condition, and weight losses are presented for general information. The data does not lend itself to correlation with current theories due to the fact that the time at which coating breakdown occurred is not known. The results give an indication of coating effectiveness. (auth)

13383 (WANL-TME-1440) ENGINEERING MECHANICS DEPARTMENT TEST PROGRAM. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1966. 36p. Dep. NTIS $5.00.

Declassified 10 Sep 1973.

The WANL Engineering Mechanics Laboratory program involves development and tests of the following reactor components: Reflectors, fuel elements, support systems, core periphery, dome end, core assembly and launch and flight test facility. Stress and strain measurements will be made on components and mechanical property measurements on materials, fuel elements, etc. With some components dynamic tests are planned; for others it will be necessary to investigate thermal stress. Friction, wear and seal leakage measurements are needed, especially at some interfaces. (LTN)

13384 (WANL-TME-1444) NRX/EST POST-OPERATIVE MECHANICAL COMPONENT EVALUATION. Mantia, T. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1966. 190p. Dep. NTIS $12.50.

Declassified 10 Sep 1973.

Upon completion of the NRX/EST test program in March 1966, the reactor was disassembled and a post-operative evaluation of all mechanical components was performed. This evaluation showed that the mechanical condition of the reactor hardware was excellent. Since this first reactor engine test involved extensive engine system testing, along with reactor endurance tests, the hardware was exposed to thermal transients and vibration environments not experienced by previous reactors. The major damage to fuel elements was caused by severe bore corrosion and breakage in elements adjacent to the core periphery, bore corrosion of elements in the central core region, and external corrosion at the element undercut areas. An interstitial corrosion pattern, similar to that seen on past reactors, appeared as a band across the mid-plane of the core. Element bonding occurred to a lesser extent than that seen on NRX-A3. The performance of the experimental taper tip element ends was found to be far superior to the standard undercut tip configurations. Support block damage at the counterbore fillet area and partial element lobe was prevalent. Coating damage, with subsequent corrosion at the inlet face, was also evident. The coating damage was apparently induced by degradation of the fuel element above the affected lobe. Corrosion of the support washers which had non-adherent coating was found to the approximate extent as that seen on NRX-A3. Filler strip tile and tile shelf corrosion was experienced to a moderate degree. Liner tube damage, apparently initiated by abnormally high tie rod coolant temperatures during an abortive shutdown, were experienced, along with discoloration and pinholes in the liner at the insulating sleeve gaps. Indications of light rubbing of control drums were seen. This rubbing was believed to be caused when the reflector test limit temperature was exceeded during startup. The performance of reactor instrumentation was excellent, with 97.4 percent of installed instruments operating at completion of the test. (auth)

13385 (WANL-TME-1480) SUMMARY OF DEVELOPMENT EFFORT IN EXTRUDED-TO-SIZE FUEL ELEMENTS. Kotulak, F. M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1966. 57p. Dep. NTIS $6.00.

Declassified 12 Sep 1973.

A development extrusion-to-size program was directed towards extrusion of an NRX-A type fuel element with "as machined" dimensional control, while maintaining or hopefully improving upon the structural integrity of the element. The aim was an improvement in element quality through better hole location, lower porosity resulting from non-machined surfaces, and a reduction in machining operations required to produce an element to drawing specifications. The objective was almost but not quite realized, mainly because element to element variations exceeded specifications, probably because of local variations in the extrusion mix and dimensional and hole location changes due to die wear and extrusion pressure changes. In any event the machining required with these elements could be reduced. The mechanical strength of these extruded-to-size elements (for both flexure and compression) compared favorably with standard elements. However, hydrogen corrosion test results were not as favorable. Mismatch and non-alignment of the holes in the non-fuel tips was a problem. Also, fuel bead "popout" occurred on the outside surfaces and in the bores. Extensive data are presented. (LTN)

13386 (WANL-TME-1489) STRESS ANALYSIS: NRX-A REGULAR AND IRREGULAR SUPPORT BLOCKS. Henne, E. A.; Lucente, F. D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Dec 1966. 91p. Dep. NTIS $7.75.

Declassified 12 Sep 1973.

Stress analyses of the NRX-A regular and irregular (peripheral) support blocks are reported. The stresses due to mechanical load (tie rod) and transient thermal stresses were computed based on a finite element computer program. The effect of counterbore fillet radius and load distribution was studied on the regular support block models and the stresses due to transient temperature conditions computed for regular and irregular support blocks. For most of the cases analyzed the computer model, temperature distribution, and resultant stresses are shown in the form of CALCOMP plots. (auth)

13387 (WANL-TME-1494) FLUID FLOW LABORATORY DEVELOPMENT TEST PROGRAM. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Oct 1966. 52p. Dep. NTIS $5.75.

Declassified 12 Sep 1973.

Research programs on fluid flow problems in various reactor components are outlined. This includes seal testing, instrumentation development and calibration (thermocouples, orifices, etc.) as well as fluid and thermal flow measurements. (LTN)

13388 (WANL-TME-1507) NOTES OF MONTHLY DEVELOPMENT TEST PROGRAM REVIEW MEETING HELD WITH SNPO AT WANL ON AUGUST 24, 1966. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1966. 24p. Dep. NTIS $4.25.

Declassified 22 Nov 1974.

Fuel element tests, process development, and corrosion testing of fuel elements for the NRX-A6 and XE-PRIME reactors continued. Miscellaneous tests on supports, seals, tie rods, insulating sleeves, etc. are reported. Thermal shock tests were run on beryllium specimens; the most severe tests resulted in cracks and led to a redesign of the part. An ultrasonic crack detection technique has been developed for use with fracture properties measurements on beryllium. (LTN)

13389 (WANL-TME-1561) STRESS ANALYSIS: XE-1. Stancampiano, P. A.; Pianka, E. W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Feb 1967. 100p. Dep. NTIS $8.25.

Declassified 10 Sep 1973.

Stress analyses performed to determine the structural adequacy of the XE-1 reactor are summarized. Tables of mechanical test limits and component margins are also presented. Much of the XE-1 design is basically similar to the NRX-A5 reactor which, like NRX-A4, demonstrated sufficient endurance to operate at rated power for approximately 30 minutes. New or redesigned components were analyzed and tested to insure their adequacy. While some improvements to the peripheral support blocks were made, perimeter wall cracks may occur. If the faster startup ramps are employed, fillet cracks may occur in both the regular and peripheral irregular blocks. Cracked and subsequently corroded support blocks have demonstrated little or no reduction in load-carrying ability during the NRX-A3 and the 30-minute NRX-A4 and -A5 power tests. Post-operative load tests of blocks from these reactors indicated virtually no reduction in ultimate mechanical strength. The XE-1 peripheral fuel should exhibit similar end-of-life damage to that seen in NRX-A4 and NRX-A5, since the radial temperature profiles and leakage flows are similar. However, one significant improvement in XE-1 is the use of nominal-size coated peripheral elements as compared to "oversized" coated elements in the NRX-A5 periphery. This condition reduces the end-of-life bundling forces substantially in XE-1 compared to NRX-A5. (auth)

13390 (WANL-TME-1562) EXPERIMENTAL INVESTIGATION OF INTERSTITIAL CORROSION FOR AN ISOTHERMAL MODEL PHASE II. Steffen, R. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1967. 93p. Dep. NTIS $7.75.

Declassified 10 Sep 1973.

A test fixture consisting of a narrow slot 0.006 inches thick, one inch wide and 2 inches long machined in a split specimen of graphitite "G" has been designed and used to generate parametric data on the hydrogen-graphite corrosion reaction. Material temperature was maintained at 3500°K, pressure levels varied from 50 to 350 psig in 50 psig steps and flow rates varied from 2.1×10^{-5} lb. H_2/sec. to 1.7×10^{-4} lb. H_2/sec. Times of experiment were 30 and 15 minutes. The results are given graphically and may be used to improve computer models of surface regression. The non-trivial problem of reducing the data to analytical form is left to the reader. (LTN)

13391 WANL-TME-1566) COMPARISON OF THE COMMON ANALOG MODEL (CAM) WITH TRANSIENT AND FREQUENCY RESPONSE. Test Data from NRX-A5. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). [nd]. 213p. $13.75.

Declassified 10 Sep 1973.

Selected transient and steady-state NRX-A5 test data results were compared with analytical calculations obtained from the DDC, ANALOG, and TAF implementations of the CAM NRX-A5B and A5C models. The purpose for using both analog and digital implementations of the CAM model was to confirm the validity of each method and also to increase confidence in the overall comparison results. The time domain DDC and Analog comparisons indicate that generally good and consistent results are obtained by both implementations. Some differences do exist, however, between analog and digital results and the more significant discrepancies are indicated. Action is being taken to identify any appropriate modifications to the CAM equations in order to improve these comparisons. A preliminary study indicates that an appropriate modification of the heat generation terms may improve the model results, particularly the chamber temperature computation. In addition to steady-state and transient data, frequency response comparisons of the NRX-A5 reactor based on cross-correlation test results and the CAM model implemented in the TAF code, have been made. From this data a significant number of transfer functions for the reactor subsystem were obtained. Many of these transfer functions covered the frequency range from 0.057 cps to 10 cps. These measured transfer functions are presented and compared where possible with corresponding transfer functions from the CAM NRX-A5 models. Generally, the transfer functions of pressures with respect to pressures obtained from the CAM-A5B model compare well with those measured from test data. The largest discrepancy occurs in the phase functions (about 15 to 30 degrees). (auth)

13392 (WANL-TME-1629) NRX-A6 DESIGN REVIEW. Morris, W. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1 Jun 1967. 222p. Dep. NTIS $14.25.

Declassified 10 Sep 1973.

13393 (WANL-TME-1635) PRELIMINARY EVALUATION OF NRX-A6 ENDURANCE CAPABILITY. Holman, R. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 Jun 1967. 40p. Dep. NTIS $5.00.

Declassified 12 Sep 1973.

Performance of NRX-A6 PAX fuel elements in electrical single element corrosion tests and fuel element performance in previous reactor tests have been evaluated to obtain a preliminary estimate of the loss of reactivity and resulting endurance capability of the NRX-A6 reactor. Element to element variations, uncertainties in the reactor and electrical test correlations, within element variations of corrosion in the reactor and variations with radial position in the reactor, greatly complicate such evaluations. However, a qualified potential for the reactor to operate for times in the range of 45 to 60 minutes results from the effort. (LTN)

13394 (WANL-TME-1642) NRX-A6 NUCLEAR SUBSYSTEM THERMAL AND NUCLEAR DESIGN DATA BOOK. Shalette, A. (ed.). (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 Nov 1967. 515p. Dep. NTIS $28.75.

Declassified 12 Sep 1973.

The results of the NRX-A6 Reactor Design Analyses are presented. The analyses were performed as an integral part of the design process and, as such, the data contains information regarding the performance of the reactor components at various transients and steady state operating conditions rather than information pertaining to the planned test conditions. (auth)

13395 (WANL-TME-1654) STRESS ANALYSIS: NRX-A6. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1967. 214p. Dep. NTIS $13.75.

Declassified 12 Sep 1973.

Stress analyses performed to determine the structural adequacy of the NRX-A6 reactor are summarized. Tables of mechanical test limits and component margins are also presented. There have been many significant changes between the NRX-A6 reactor and previous reactors. All the new and/or redesigned components were analyzed and tested to demonstrate their adequacy. These analyses and tests show that the reactor will have no structural damage for the planned 50°R/sec startup profile, up to 60 minutes of full power steady state operation, and the planned 25°R/sec shutdown. It has also been shown that the emergency shutdown and normal shutdowns from large control drum angles will cause no structural damage to components other than the filler strips, and that this filler strip damage will not impair operation of the reactor. (auth)

13396 (WANL-TME-1671) NRX-A6 ELEMENT PLACEMENT AND ORIFICING. Summary Report. Agosti, R. J.; Cort, G. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 30 Oct 1967. 188p. Dep. NTIS $12.50.

Declassified 12 Sep 1973.

Pertinent data for the NRX-A6 reactor core is presented in tabular form. The physical location of elements, nuclear shimming, instrumentation, number and sizes of orifices, element thermal and flow characteristics, supplier, coating batch run numbers, and other physical data are presented. Also included is an overall summary of the elements grouped according to the matrix and coating supplier, the corrosion test results for the element used to qualify each coating batch, and a separate listing of the experimental elements. (auth)

13397 (WANL-TME-1739) WANEF CRITICAL EXPERIMENTS IN SUPPORT OF NERVA. Quarterly Report, 3rd Quarter CY'67. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1968. 151p. Dep. NTIS $10.75.

Declassified 10 Sep 1973.

PAX critical experiments in support of the NRX-A6, identified

as PAX-E1 and PAX-E2, were performed. The major difference was in the reflector region. PAX-E1 used the actual NRX-A6 beryllium reflector rings, but PAX-E2 used the reflector previously used for experiments in support of NRX-A6. It consists of three 30 degree mockup sectors of the NRX-A6 type with thin beryllium liner plates and 9 KIWI sectors each with a thick beryllium liner plate. In both configurations, the reactor core remained the same. This A6 core had a 90 degree mockup NRX-A6 Build 2 fuel, and a 270 degree rezoned PAX-D fuel loading. Specific experiments performed included the initial approach to criticality, drum worth measurements, fuel interchange-PAX fuel to A6 Build 2, reactivity worths – U, C, and poison rod content verification. Radiation detection experiments consisted of both gamma and neutron detecting techniques. (auth)

13398 (WANL-TME-1742) THEORY AND OPERATION OF INDUCTOTHERM ELEMENT COATING FURNACES. Malick, F. S. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 22 Jan 1968. 31p. Dep. NTIS $4.75.

Declassified 10 Sep 1973.

New processes for the coating of fuel elements require a larger temperature gradient between the ends of the element than can be obtained with the present furnace coils and furnace controls. A test and analysis program was performed to determine a method for obtaining large temperature gradients necessary in the preparation of fuel elements for nuclear reactors. The information obtained is presented as a manual for the operation of Inductotherm element-coating furnaces. In addition, the contents can be utilized by nonelectrical engineers. The information develops the theory on: (1) the operation of an induction furnace, (2) the use of capacitors in the control console, and (3) the temperature profile control by the use of shunting saturable reactors. An operating procedure for the control of furnace zone temperatures is presented by explaining the results of an actual furnace test. In conclusion, steep profiles can be obtained by the addition of two inexpensive components in the control console, and with no furnace modifications. The temperature control procedure permits the control of temperature to a precision of ±10°C. (auth)

13399 (WANL-TME-1779) RADIATION EFFECTS TESTING OF LINEAR VARIABLE DIFFERENTIAL TRANSFORMERS USED IN NERVA PROGRAM. Coombe, J. R.; Remley, G. A.; Brown, R. K. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 11 Apr 1968. 29p. Dep. NTIS $4.50.

Declassified 11 Sep 1973.

The LVDT is an electrical transducer capable of measuring the displacement of mechanical components. Availability of LVDT's which will perform satisfactorily in the environment of the NERVA reactors is necessary from a diagnostic instrumentation standpoint. The present LVDT suffers a significant and undesirable drift in NERVA applications. It is recommended that a radiation test be included in the program in order to establish the cause of the drift and to establish corrections necessary for the application of the device. A detailed discussion of LVDT design, operating principles, radiation effects, and current development status is included. An LVDT environmental and performance history of A5, A6 and past radiation tests is recorded. (auth)

13400 (WANL-TME-1789) POST-OPERATIONAL EXAMINATION OF NRX-A6 FUEL ELEMENTS. Phase II. Report on Weight Loss and Visual Examination Data. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jun 1968. 319p. Dep. NTIS $19.00.

Declassified 11 Sep 1973.

The corrosion performance of NRX-A6 fuel elements was characterized by the following observations: With the exception of some peripheral positions, the time rate of corrosion (gross weight loss) for the NRX-A6 elements was approximately 20 to 25 percent of that observed for the elements in the NRX-A4 and NRX-A5 reactors. Surface corrosion effects were mild compared to those of NRX-A4 and NRX-A5. This is attributed to tight, uniform element bundling, improved radial power flattening, and superior bore corrosion performance. Paradoxically, these characteristics resulted in 100 percent of the non-OD coated elements having some degree of inter-element bonding through pyrographite interstitial deposits. The difficulties attendant with the removal of bonded elements from the core resulted in mechanically-induced breakage of approximately 200 fuel elements. Of all of the broken elements in NRX-A6, a maximum of eighteen were broken at positions of severe corrosion; most of these were peripheral elements. In addition to lower overall weight losses, the NRX-A6 fuel elements had much lower break frequencies and weight losses for the broken elements. Again, it should be pointed out that A6 fuel elements were broken due to the mechanical effects of bonding, while the A5 elements were broken because of corrosion weakening. Pinhole and coolant channel exposure occurrences in NRX-A6 elements were noticeably less frequent than observed in NRX-A4 and NRX-A5. In general, the corrosion performance and integrity of the aft-coated ends of NRX-A6 fuel elements were excellent. The bearing area remaining and coated area remaining in the 50 to 52 inch region averaged approximately 95 percent. Corrosion local to the unfueled tip joint region was observed on approximately thirty elements. Preliminary examinations have not yet established whether this corrosion can be attributed to a joint leakage problem or to external surface corrosion effects on these elements. Initial comparisons of the weight losses of experimental elements (NbC additives and impregnated) with radial neighboring elements showed higher gross weight losses for the experimental elements. Studies in progress are expected to show if this difference can be attributed to overall poorer performance or are due to thermal, orificing, or coating batch effects. The higher weight losses observed for certain peripheral positions has been attributed to local thermal and/or mechanical stress problems. (auth)

13401 (WANL-TME-1798(Vol.3)) THERMAL AND FLUID FLOW ANALYSIS. Volume III. Rieke, K. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 26 Jun 1968. 305p. Dep. NTIS $18.25.

Declassified 11 Sep 1973.

The thermal, fluid flow and corrosion analysis of the NERVA I Reactor and of those major structural components defined as Engineering Critical Components (ECC) are presented. Included is a chapter reviewing the Nuclear Subsystem (NSS) thermal requirements and a discussion of the NSS Thermal and Fluid Environment Drawing which will be utilized to present the environmental conditions for all operating and non-operating conditions. Information on the startup and shutdown of the reactor as well as the overall thermal, fluid flow and corrosion characteristics is presented. A chapter is devoted to the thermal, fluid flow and corrosion analysis performed on the candidate designs for each ECC. Each chapter includes a summary, the thermal and fluid flow requirements as given in the ECC, and an analysis section. The analysis section includes the methods, assumptions, results of analysis, and the pros and cons from the thermal, fluid flow and corrosion standpoint of each of the designs being evaluated. (auth)

13402 (WANL-TME-1808) NOTES OF MONTHLY DEVELOPMENT TEST PROGRAM REVIEW MEETING HELD WITH SNPO AT WANL ON JUNE 4, 1968. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). [nd]. 55p. Dep. NTIS $5.75.

Declassified 11 Sep 1973.

Tests reported were related to the NRX-A6, PEWEE-1 and R-1 reactors. Fuel element development, corrosion testing and mechanical properties testing received the most attention. PEWEE-1 fuel elements had an average compressive ultimate strength of about 10,000 psi at room temperature and about 14,000 psi at 4100°R. Most specimens exhibited brittle failure. Problems of failure or slippage in the grips and large specimen variability were encountered in tension tests. Miscellaneous other test results and test facility preparations are reported. (LTN)

13403 (WANL-TME-1841) R-1 COMMON ANALOG MODEL. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1968. 64p. Dep. NTIS $6.25.

Declassified 11 Sep 1973.

The R-1 Common Analog Model (R-1 CAM) is defined. The R-1 test system will consist of the 1575 MW R-1 reactor and the Test Cell "C" feedsystem (single pump mode). A dynamics simulation of this test system has been developed to provide a common reference for NERVA R-1 dynamics analysis. Aerojet-General Corporation has provided the model equations and coefficients for the nozzle, including the thrust chamber thermocouple. (auth)

13404 (WANL-TME-1847) FUEL DEVELOPMENT TEST SPECIFICATION. Phase IV-A. Qualification Coating Process. Final Report. Chasko, J. P. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1969. 62p. Dep. NTIS $6.25.

Declassified 11 Sep 1973.

The "GEM" process employs methane in the coating gas stream and deposition temperatures in the range of 1000° to 1100°C to coat fuel elements. The low coating temperature and the avoidance of carbon depletion in the graphite matrix combine to produce extremely adherent coatings. The concepts underlying this "GEM" process as deposited on a set of standard hi-void fraction fuel elements are described and the results of its implementation are presented. (auth)

13405 (WANL-TME-1865) TEST SPECIFICATION ID_c DEVELOPMENT OF HOT END OVERCOATING. Final Report. Kochka, E. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 16 Oct 1968. 23p. Dep. NTIS $4.25.

Declassified 11 Sep 1973.

The purpose of Test Specification ID_c was to develop processes for depositing zirconium carbide on the hot end of NbC-coated fuel elements, to assess the effects of the overcoating process on the base coat, and to evaluate the performance of the overcoating in cyclic corrosion tests. Processes for both HED and HEM overcoating were developed, but only HEM-overcoated elements were corrosion tested. Neither of the overcoating processes degraded the basic NbC GEM coating. The corrosion-tested elements showed that there was a significant general improvement in the corrosion test performance as a result of the overcoating. Development work on a ZrC overcoating process is continuing. (auth)

13406 (WANL-TME-1898) IRRADIATION OF BATH SHIELD MATERIAL AT AMBIENT TEMPERATURES. Shogan, R. P. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). [nd]. 22p. Dep. NTIS $4.25.

Declassified 12 Sep 1973.

An irradiation of an extrusion of the NERVA 70-30 BATH shielding material was completed in WANL Irradiation Test #37/W407 at the Plum Brook Reactor Facility. Neutron fluences were 8.2×10^{19} n/cm^2 (E < 0.48 eV) and 9×10^{18} n/cm^2 (E > 1 MeV). The irradiation temperature was 590°R. The irradiation caused an increase in the 0.2% offset tensile and compressive yield strengths and a decrease in the tensile elongation. The ultimate tensile strength, thermal conductivity, dimensions and hydrogen content were not affected. (auth)

13407 (WANL-TME-1902) SUMMARY REPORT ON WESTINGHOUSE ASTRONUCLEAR LABORATORY EFFORTS ON THRUST NULLING. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Mar 1969. 44p. Dep. NTIS $5.25.

Declassified 12 Sep 1973.

The work to date has indicated the feasibility of using hydrogen flow through the core structural support system as a means of removing the latter time portions of the core decay heat. This allows piping the effluent to a common location where it can be directed through thrust nulling devices. Conclusions which can be drawn on the use of reactor cooldown for thrust nulling are as follows: Systems for cooling down the reactor primarily through the core structural support system and collecting the coolant for discharge to thrust nulling devices cannot be used sooner than 9 times the run time if fed by 30 psia tank pressure, or in the limit case, 0.4 times the run time if feed pressures of 315 psia are used. If a tank fed core structural support coolant system is used for thrust nulling, the time after a run when it will be capable of removing the core heat will be dependent on the finally selected tank pressure. The use of a reactor decay heat coolant scheme which uses the core structural support system will result in a significant reduction in heat removal per pound by the coolant due to maximum temperature limitations in the reactor components. From the standpoint of efficient reactor decay heat removal for thrust nulling, the most desirable scheme is one that allows use of the coolant in the primary passages of the core. Thus, thrust nulling concepts applied to the thrust chamber would minimize the amount of cooldown propellant and make it possible to go into thrust nulling at short times after shutdown on tank pressure. A thrust nulling device is being added to the NERVA reference design. This design incorporates core structural support system flow and parallel reflector flow with the combined flow being collected and discharged to the thrust nulling device. The capabilities of this system are presently being evaluated. (auth)

13408 (WANL-TME-1916) PAX-G1 REFLECTOR INTERCHANGE, CONTROL DRUM SPAN, AND ALUMINUM REFLECTOR BARREL EXPERIMENTS. Final Test Report. Rowland, J. W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1970. 73p. Dep. NTIS $6.75.

Declassified 28 May 1970.

Reflector reactivity experiments have been performed in support of the R-1 design on the PAX-G1, the first nuclear mockup of an 18-drum R-1 design. The first experiment determined the reactivity effects caused by interchanging a 60° reflector sector containing three R-1 type control drums for two 30° sectors, each of which contained one NRX type control drum. Analytical predictions of the worth of the interchange were in excellent agreement with the measurements. The second experiment entailed various measurements of the control drum spans. Two different experimental procedures were employed, both of which yielded very nearly the same results. Comparison of analytical predictions with the experimental data yielded a drum span correction factor of 0.88. Substantial drum interaction effects between the individual R-1 mockup drums were also demonstrated. The third experiment entailed the interchange of an aluminum reflector barrel mockup for a graphite lateral support mockup on the 60° R-1 mockup reflector sector. The effects of the liner segments interchange on the R-1 mockup control drums were also determined. In both cases, the analytical predictions were in good agreement with the experimental data. (auth)

13409 (WANL-TME-1924) WESTINGHOUSE ASTRONUCLEAR LABORATORY CONTRIBUTION TO THE TWENTY-EIGHTH HIGH TEMPERATURE FUELS COMMITTEE MEETING, 13–15 MAY 1969. Fleischer, L. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Apr 1969. 22p. Dep. NTIS $4.25.

Declassified 12 Sep 1973.

A new series of reactor tests has been inaugurated. These small reactors, designated PEWEE-1 and PEWEE-2, are a joint venture with LASL. They are intended primarily as tests of fuel development; although the core size and number of fuel elements is relatively small, each element is tested in an environment equivalent to that of full scale rocket reactors. The fuels tested will represent experimental materials and variants of present production parameters. The results will be fed back for use in further PEWEE tests and ultimately in further rocket reactor tests. Electrically powered tests are still being carried on with individual fuel elements and fuel element clusters. These tests are intended to serve a variety of functions from exploration of degradation mechanisms to quality control. Not the least among these functions is screening the large number of controllable parameters available in fuel element production and structure. (auth)

13410 (WANL-TME-1930) FEASIBILITY EVALUATION OF ALTERNATE NSS SOURCES FOR TURBINE DRIVE GAS. Thompson, R. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). May 1969. 72p. Dep. NTIS $6.75.

Declassified 12 Sep 1973.

This feasibility study included consideration from the NSS' standpoint of the basic concepts for providing turbine drive fluid at the required pressure and temperature conditions. The concepts evaluated were structural support discharge flow, peripheral flow, core bleed, separate nuclear heater for turbine drive fluid, separate nuclear heater for turbine exhaust, heat pipes, portion of core partitioned as turbine supply, and fueled central elements. For each concept, energy addition requirements were considered and the attainable fluid temperature was determined. Also considered for each concept were the magnitude of the NSS development and redesign required and the development risks involved. For each concept, at least one typical means of implementation was developed to permit representative evaluation. (auth)

13411 (WANL-TME-2673) NERVA REFLECTOR ASSEMBLY DESIGN CONCEPTS. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Feb 1970. 454p. Dep. NTIS $25.75.

Declassified 10 Sep 1973.

A Trade Study of design concepts for the Reflector Assembly, a component of the NERVA Nuclear Subsystem (NSS), is described. The design concepts evaluated are: Beryllium Ring Design, and Aluminum Structure Design. Each concept is evaluated against the requirements, and the selection is based on an objective approach using a comparison matrix that identifies the concept having the maximum likelihood of meeting the functional, technical and programmatic requirements. The Aluminum Structure Design is the concept selected and recommended for continued detail design and development. The major factors leading to this selection are described. (auth)

13412 (WANL-TME-2674) FUEL ELEMENT DESIGN CONCEPTS. Trade Study No. 759. Zwillich, A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Mar 1970. 530p. Dep. NTIS $29.50.

Declassified 10 Sep 1973.

A Trade Study of design concepts for the Fuel Elements of the NERVA Nuclear Subsystem is described. The purpose is to evaluate and select the most logical and reasonable concept for continued detail design and development consistent with the programmatic and technical requirements for the 10 hour, full flow cycle engine defined in the NERVA Program Requirement Document. Nine design concepts were evaluated. The evaluation and selection was based on the construction of a comparison matrix. Each concept was evaluated against the requirements and the tentative selection based on an objective approach which identifies the concept having the maximum likelihood of meeting the functional, technical and programmatic requirements. Three concepts were selected and recommended for continued detail design and development. The major factors leading to this selection are described. (auth)

13413 (WANL-TME-2708) TEST SPECIFICATIONS 3012 AND 3017 PEWEE 2 DUPLEX COATING DEVELOPMENT. Final

Report. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1 Jul 1970. 115p. Dep. NTIS $8.75.
Declassified 11 Sep 1973.
Work done to develop a coating for use in the Pewee 2 reactor is described. Information is presented on refining the NbC methane coating process and developing both methane and diffusion coating processes for ZrC. Corrosion test performance of coated elements is discussed and the development of the Pewee 2 coating process is presented. (auth)

13414 (WANL-TME-2733) CENTRAL ELEMENT PYROFOIL SEAL TEST. Final Report. Garey, R. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1970. 61p. Dep. NTIS $6.25.
Declassified 11 Sep 1973.
The central element pyrofoil seal was designed to prevent the core inlet plenum gas from flowing into the core exit plenum by way of the gap between the central element bore and the liner tube. The central element bore is approximately .100 inch larger than the liner tube O. D. Pyrolytic graphite insulating sleeves are inserted into the annulus along the length of the central element. The seal was designed to be force fitted into the annulus. This produces a blockage to flow and a hoop stress in the central element. Seals of various lengths and wall thickness were designed for the test. The intent of the test series was to determine the best seal length and wall thickness to provide effective sealing without causing excessive hoop stress in the central element. The performance of the seal was evaluated against the amount of hydrogen leakage which could be tolerated based on the resultant amount of insulating sleeve corrosion calculated for 10 hours of reactor operation. As a result, the .25 inch long seals with a loose or medium fit were found to be the best. An additional series of tests were conducted to determine the central element strength at the threads in the forward end. Strength data were obtained for both plain and instrumented central elements. (auth)

13415 (WANL-TME-2734) STEM ASSEMBLY STRUCTURAL TEST. Final Report. Polinak, D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1970. 87p. Dep. NTIS $7.50.
Declassified 11 Sep 1973.
Multiple tests were conducted on fabricated assemblies to determine the structural adequacy of the components and to verify the analytical techniques for predicting structural adequacy. These tests consisted of tensile, pressure, flexure, and vibration tests on components and complete stem assemblies. The liner tubes were made from Type 316 stainless steel and the support stems from Inconel 718. The results showed that the components are structurally adequate at the conditions tested and that a high margin of safety exists. The tests also confirmed that the analytical techniques are valid since there is good agreement between predicted effects and experimental results. The room temperature tensile tests on the support stems resulted in an average yield load of 2370 lbs. and an average ultimate load of 2790 lbs. The room temperature pressure tests on the liner tube assembly resulted in an average ultimate pressure of 4470 psig. A comparison between the strength of rolled thread specimens and ground thread specimens was made. The ground Inconel 718 thread specimens were found to be stronger than the rolled thread specimens. Ultimate loads on ground threads averaged 6532 lbs. at room temperature and 5198 lbs. at 1760°R. Ultimate loads on rolled threads averaged 5461 lbs. and 4598 lbs. at room temperature and 1760°R, respectively. (auth)

13416 (WANL-TME-2746) STRUCTURAL TESTING OF SECONDARY SUPPORT ASSEMBLY. Smith, R. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1970. 57p. Dep. NTIS $6.00.
Declassified 11 Sep 1973.
The structural testing and analysis performed to evaluate the tensile, compressive and flexure characteristics of the secondary support assembly at the cold end of a NERVA graphite cluster is described. A series of tests were conducted by loading the cold end of a prototype cluster assembly to failure. The tests were: Tensile load at room temperature, tensile load at room temperature with flexure, and flexure load at room temperature. (auth)

13417 (WANL-TMI-275) KIWI-B5 SHIELD CAPSULE AXIAL NATURAL FREQUENCIES. Miller, D. F. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 26 Sep 1962. 5p. Dep. NTIS $4.00.
Results of axial vibration tests of a loaded KIWI-B5 Shield Capsule are reported. The capsule withstood without obvious damage sinusoidal fixed frequency vibrations of 2 G peak at 5 Hz and 7 G peak at 650 Hz for 45 minutes each. These were resonant frequencies found in a frequency sweep. Axial resonance of the capsule occurred at 2700 Hz. (LTN)

13418 (WANL-TNR-021) RELIABILITY PROGRAM PLAN, Phase I. NERVA Nuclear Subsystem. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Mar 1962. 42p. Dep. NTIS $5.25.
Declassified 10 Sep 1973.
A Reliability Program Manual has been established and is described. The purpose is to serve as a procedural guide for all reliability activities during the design and development program on the nuclear subsystem. It defines in detail the activities required early in the program which are, in general, related to the design effort. General criteria are outlined for activities required later in the program, such as quality assurance procedures, vendor control, etc. The planned reliability monitoring program is described, including a tentative apportionment of engine reliability goals to the components of the nuclear subsystem. These apportioned goals will be subject to change based on a planned joint Aerojet-Westinghouse effort to apportion the engine reliability goals to the major subsystems. The methods which will be used to assess the reliability status and the use of reliability growth curves and block diagrams in reporting the reliability status are described. A schedule is shown for the completion of the major reliability program events during the follow-on phase. In addition, key reliability activities are described for the reactor components to the time of manufacturing release for the NRX-1 reactor, and for the control components to the release for the initial engine tests. These activities are shown in chart form in relationship to the design and development activities. (auth)

13419 (WANL-TNR-182(Ph.1)) STEADY STATE IRRADIATION BEHAVIOR OF NERVA FUEL MATERIAL: PHASE I. Jacobs, D. C.; Glassmire, C. M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 13 Oct 1964. 31p. Dep. NTIS $4.75.
Declassified 11 Sep 1973.
A total of twelve samples of NERVA fuel were irradiated. Each sample had one of the following pre-treatments: (a) hydrolysis, (b) hydrogen corrosion, or (c) no treatment. The irradiations were conducted at temperatures 1200°C to 2500°C to burn-ups 2×10^{16} to 2×10^{17} fiss/cm^3. The temperature gradients achieved were 400 to 1100 C°/in. The untreated fuel material exhibited excellent stability at all irradiation conditions. The hydrogen corroded and hydrolized materials suffered considerable damage. These materials became friable and were severely cracked. It is believed that these results were caused by the interaction of residual and thermal stresses. On the basis of the results it is concluded that hydrolysis and hydrogen corrosion serve to reduce the apparent strength of NERVA fuel material. The behavior of the hydrolized material is significant with respect to the ground test restart capability of the NRX-A. To prevent hydrolysis during intermittent shutdowns, it is suggested that adequate precautions be taken in the storage of the core between the reactor cycles. (auth)

13420 (WANL-TNR-220) NRX-A5 FINAL REPORT. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1967. 97p. Dep. NTIS $8.00.
Declassified 10 Sep 1973.
The NRX-A5 test series results are summarized. The most significant operations and accomplishments were: The Test Assembly was operated for 29.4 minutes at, or above, chamber temperatures of 3800°R and for 22.4 minutes at, or above, chamber temperatures of 4000°R (average core exit gas temperature was at, or above, 4000°R for 24.7 minutes); operation of a new eight decade neutronic system was demonstrated in which the neutronic detectors were located on the test car under the Test Article and used as the neutronic system feedback; the reactor was checked out and operated at rated conditions using a temperature control system without the neutronics power control as an inner loop; the acceptability of a startup from low power to near rated conditions using programmed LH_2 flow with drums in a fixed position was demonstrated; and the initial criticality of the reactor was performed after all poison wires were removed. The Average Control Drum Angle Test Parameter Limit of 145 degrees was reached after a total accumulated operating time of 30.75 minutes at, or above, 1000 MW, thereby forestalling achievement of the prime objective, operation at design conditions for a total accumulated time of forty minutes. Performance analyses and post-operative examination results are included. (auth)

13421 NUCLEAR SHIPS: SERIES OF 414,000-TONNERS IN ENERGY CORPORATION OF AMERICA PROJECT. Skipsteknikk; 12: No. 4, 30-33(Apr 1974). (In Norwegian).
It is reported that the Department of Trade in Washington has received an application for the subsidized building of a series of 414,000 dwt nuclear powered tankers from Energy Corporation of America. A new form of hull construction has been developed to

attain a better protection of the nuclear plant. It is found that under the present economic conditions such ships will be competitive with conventionally powered tankers. (NO)

13422 STUDIES ON COLLISION PROTECTIVE STRUCTURES FOR NUCLEAR POWERED SHIPS. Nippon Zosen Kenkyu Kyokai Hokoku; No. 71, 1-63(Jul 1971). (In Japanese).

Equations for the calculation of absorbed collision energy with high accuracy were determined as a result of studies by the 3rd Study Group on Nuclear Ships. A procedure for determining the strength of the hull side structure of nuclear ships against collision is shown. Distinguishing buckling and intruding type fractures of the hull side structure, equations for estimating the absorbed energy by the hull side structure are given. Experiments with static loads simulating intrusion of a rigid stem into the hull was carried out, its result was analyzed, and fracture conditions and capability of energy absorption were elucidated. Empirical formulas were determined, and in order to supply the formulas to actual collision phenomena, dynamic experiments were carried out to investigate collision fracture behavior. Two models of horizontal rib side structures in which intruding and buckling type fractures are expected to occur and a rigid stem model were employed. The absorbed energy at the time of collision of actual ships can be estimated on the basis of results of the static analysis, when it is taken into consideration that the absorbed energy in dynamic fracture is larger than in static fracture due to the effect of mean strain rate. The rate of sharing the absorbed energy between stem and side structures when the stem is soft was also confirmed by experiment. (JA)

13423 SECOND REPORT ON THE NUCLEAR SHIP STUDY. London; Her Majesty's Stationery Office (1975). 99p.

Information is presented under the following headings: economic assessment; safety and operating procedures; productive capacity. The information is intended to provide a background for discussions between interested parties. The rise in oil prices is seen to have an important effect on the economics of nuclear merchant ships. It is suggested that the most promising application of marine nuclear power for the UK would be in container ships instead of tankers. Uncertainties are pointed out, particularly in the economic consequences of new problems brought out in the consideration of the safety and operating procedures and productive capacity, and only after a full reappraisal could these problems be resolved. (UK)

13424 HISTORY OF THE DEVELOPMENT OF ZIRCONIUM ALLOYS FOR USE IN NUCLEAR REACTORS. Washington, DC; Energy Research and Development Administration, Division of Naval Reactors (1975) 86p.

An outline is presented of the technical problems identified and the major decisions made during the initial development and production of zirconium alloys for use in naval reactors. (DG)

13425 GRAPHITIC FUELS FOR THE NUCLEAR ROCKET ENGINE. Taub, J. M. (Los Alamos Scientific Lab., NM). Trans. Am. Nucl. Soc.; 21: 173-174(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13426 COMPUTER PROGRAM FOR OPTIMIZED DESIGN OF MOBILE NUCLEAR POWER PLANTS. Ravets, J. M.; Parker, W. G. (Westinghouse Astronuclear Lab., Pittsburgh). Trans. Am. Nucl. Soc.; 21: 424-425(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

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Refer also to abstracts 11259, 11553, 11554, 13669, and 13685.

13427 (ANCR-1188) ERROR ANALYSIS FOR 1½-LOOP SEMISCALE SYSTEM ISOTHERMAL TEST DATA. Feldman, E. M.; Naff, S. A. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). May 1975. Contract AT(10-1)-1375. 119p. Dep. NTIS $5.45.

An error analysis was performed on the measurements made during the isothermal portion of the Semiscale Blowdown and Emergency Core Cooling (ECC) Project. A brief description of the measurement techniques employed, identification of potential sources of errors, and quantification of the errors associated with data is presented. (auth)

13428 (ANCR-1198) EXPERIMENT DATA REPORT FOR SEMISCALE MOD-1 TEST S-01-1 (Isothermal Blowdown With Core Resistance Simulator). Zender, S. N.; Crapo, H. S.; Jensen, M. F.; Sackett, K. E. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). Apr 1975. Contract AT(10-1)-1375. 161p. Dep. NTIS $7.60.

Recorded test data are presented for Test S-01-1 of the semiscale Mod-1 isothermal blowdown test series. Test S-01-1 is one of several semiscale Mod-1 experiments which are counterparts of the planned Loss-of-Fluid Test (LOFT) nonnuclear experiments. System hardware is representative of the LOFT design, selected using volumetric scaling methods, and initial conditions duplicate those identified for the LOFT nonnuclear tests. Test S-01-1 was conducted from an initial temperature of 540°F and an initial pressure of 1596 psig. A simulated intermediate size double-ended hot leg break (0.00145 ft² break area on each end) was used to investigate the system response to a slow depressurization transient. An orificed structure was used in the pressure vessel to simulate the LOFT core simulator. During system depressurization, coolant was injected into the vessel downcomer inlet annulus to investigate the effectiveness of injection into the inlet annulus with respect to delivery of coolant to the lower plenum. Following the blowdown portion of Test S-01-1, coolant spray was introduced into the pressure suppression tank to determine the response of the pressure suppression system. The purpose of this report is to make available the uninterpreted data from Test S-01-1 for future data analysis and test results reporting activities. The data, presented in the form of graphs in engineering units, have been analyzed only to the extent necessary to assure that they are reasonable and consistent. (auth)

13429 (ANCR-1199) EXPERIMENT DATA REPORT FOR SEMISCALE MOD-1 TEST S-01-1B (ISOTHERMAL BLOWDOWN WITH CORE RESISTANCE SIMULATOR). Crapo, H. S.; Jensen, M. F.; Sackett, K. E.; Zender, S. N. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). May 1975. Contract AT(10-1)-1375. 179p. Dep. NTIS $7.60.

Recorded test data are presented for Test S-01-1B of the semiscale Mod-1 isothermal blowdown test series. System hardware is representative of the LOFT design, selected using volumetric scaling methods, and initial conditions duplicate those identified for the LOFT nonnuclear tests. Test S-01-1B is a repeat of Test S-01-1 with the exception that simulated FCC was injected into the cold leg of the intact loop rather than into the inlet annulus of the downcomer. The principal objective of Test S-01-1B was to determine whether a different ECC injection would significantly alter the system response during the period of ECC injection. Test S-01-1B was conducted from an initial temperature of 541°F and an initial pressure of 1630 psig. A simulated intermediate size double-ended hot leg break (0.00145 ft² break area on each end) was used to investigate the system response to a slow depressurization transient. An orificed structure was used in the pressure vessel to simulate the LOFT core simulator. Following the blowdown portion of Test S-01-1B, coolant spray was introduced into the pressure suppression tank to determine the response of the pressure suppression system. (auth)

13430 (ANL-CT-75-41) MIX: A COMPUTER CODE FOR TRANSIENT THERMAL-HYDRAULIC ANALYSIS OF LMFBR OUTLET PLENUMS. Lorenz, J. J. (Argonne National Lab., Ill. (USA)). May 1975. Contract W-31-109-eng-38. 111p.

AT.

A 2-D computer code (MIX) is developed for steady state and transient thermal-hydraulic analysis of LMFBR outlet plenums. A vorticity-stream function (ζ, ψ) approach is employed along with a coupled energy equation to account for buoyancy effects. The finite difference equations are expressed implicitly and are, therefore, not stability limited by either the Courant or diffusion conditions. Upwind differencing is used to enhance the stability of the convective terms. Turbulence is treated by a modified laminar approach assuming constant effective Reynolds and Peclet numbers. Sufficiently detailed programming instructions are included so that this report will serve as a users guide. Instructions to the code are primarily by data card input. It is shown that MIX predictions are in reasonably good overall agreement with available experimental data. (auth)

13431 (BAW-10102) ECCS EVALUATION OF B AND W'S 205-FA NSS. Lowe, R. J.; Anderson, G. E. Jr.; Dunn, B. M. (Babcock and Wilcox Co., Lynchburg, Va. (USA). Nuclear Power Generation Div.). Jun 1975. 158p. Babcock and Wilcox, Lynchburg, VA.

The effectiveness of the ECCS for B and W's 205-fuel assembly plants is evaluated and shown to meet all the requirements of 10 CFR 50.46. The results of various sensitivity studies, a spectrum of breaks, and an analysis to determine allowable linear heat rates under 10 CFR 50.46 are presented. 14 references. (auth)

13432 (BAW-10105) ECCS EVALUATION OF B AND W'S 177-FA RAISED-LOOP NSS. Bloomfield, W. L.; Cartin, L. R.; Hill, J. M.; Oren, M. R.; Salm, R. J. (Babcock and Wilcox, Co.,

Lynchburg, Va. (USA). Nuclear Power Generation Div.). Jun 1975. 184p. Babcock and Wilcox, Lynchburg, VA.

The effectivness of the ECCS for B and W's 177-FA plants with raised loop design has been evaluated and shown to meet all requirements of 10 CFR 50.46. The results of various sensitivity studies, a spectrum of breaks, and an analysis to determine the linear heat rates allowable under 10 CFR 50.46 are presented. 13 references. (auth)

13433 (BMI-X-657) REACTOR SAFETY PROGRAM APPLICATIONS AND COORDINATION. Task 1. Steam-Water Mixing Program and System Hydrodynamics. Quarterly Progress Report, January–March 1975. Cudnik, R. A.; Flanigan, L. J. (Battelle Columbus Labs., Ohio (USA)). 30 Apr 1975. Contract W-7405-eng-92. 46p.

A description is given of analytical and experimental studies being conducted to extend the understanding of steam-water interaction phenomena and processes associated with a loss-of-coolant accident. Blowdown parameter information for typical PWR's based on both vendor- and NRC-supplied loss-of-coolant accident analyses were derived and tabulated. Experimental studies of lower plenum filling were carried out in a $^1/_{15}$-scale transparent vessel model. Data were obtained over a broad range of ECC water temperatures, ECC water flow rates, and reverse core steam flow with injection of only ECC water and ECC water and cold leg steam. The inclusion of cold leg steam did not affect model operation with respect to initiation of bypass, but beyond that point the percentage of injected water reaching the lower plenum was measurably less with cold leg steam included. Limited studies were conducted in which ECC water was injected directly into the lower plenum. Essentially no bypassing occurred as long as the water level in the plenum was greater than 2 to 4 annulus gap widths below the bottom of the core barrel. (auth)

13434 (CENPD-184) SAFETY-RELATED RESEARCH AND DEVELOPMENT FOR C–E PRESSURIZED WATER REACTORS, 1974 Program Summaries. (Combustion Engineering, Inc., Windsor, Conn. (USA)). May 1975. 99p. Combustion Engineering, Inc., Windsor, CT.

13435 (CONF-750527-2) ANALYSIS OF TRANSIENT FUEL FAILURE MECHANISMS: SELECTED ANL PROGRAMS. Dietrich, L. W. (Argonne National Lab., Ill. (USA)). 1975. 28p. Dep. NTIS $4.50.

From international working group on fuel failure mechanisms; Seattle, Washington, USA (11 May 1975).

Analytical programs at Argonne National Laboratory related to fuel pin failure mechanisms in fast-reactor accident transients are described. The studies include transient fuel pin mechanics, mechanics of unclad fuel, and mechanical effects concerning potential fuel failure propagation. (JWR)

13436 (COO-5152-15) TWO PHASE PRESSURE DROP ACROSS ABRUPT AREA CHANGES. Husain, A.; Weisman, J. (Cincinnati Univ., Ohio (USA)). Jan 1975. Contract AT(11-1)-2152. 120p. Dep. NTIS $9.00.

This research was undertaken to develop a coherent view of two-phase pressure drop across abrupt area changes during steady flow. Specifically the objectives of this program were to: establish an additional data base of observations of two-phase pressure drop across abrupt area changes; and determine whether a single model based one-dimensional momentum theory can correlate the data obtained in the present investigation as well as that in the literature. The Freon-Freon vapor system was selected for this test program. An available loop, capable of producing a mixture of Freon liquid and vapor, was modified for these tests. The first part of the experimental program consisted of a series of observations of the transition from homogeneous to non-homogeneous flow. The bulk of the experimental observations were devoted to abrupt area change pressure drops. The data obtained and the available information from the literature were tested against several predictions based upon a one-dimensional momentum balance. (22 references) (auth)

13437 (DOCKET-RM-50-1(Vol.3)(7-73)) FINAL ENVIRONMENTAL STATEMENT CONCERNING PROPOSED RULE MAKING ACTION: NUMERICAL GUIDES FOR DESIGN OBJECTIVES AND LIMITING CONDITIONS FOR OPERATION TO MEET THE CRITERION "AS LOW AS PRACTICABLE" FOR RADIOACTIVE MATERIAL IN LIGHT-WATER-COOLED NUCLEAR POWER REACTOR EFFLUENTS. Volume 3. Comments on the Draft Environmental Statement and Staff Responses Thereto. (Energy Research and Development Administration, Washington, D. C. (USA)). Jul 1973. 332p. (WASH-1258(Vol.3)(7-73)). Dep. NTIS $19.75.

13438 (GA-A-13386) PLANNING GUIDE FOR VALIDATION OF FISSION PRODUCT TRANSPORT CODES. Jensen, D. D.; Haire, M. J.; Baldassare, J. E.; Hanson, D. L. (General Atomic Co., San Diego, Calif. (USA)). 15 Apr 1975. Contract AT(04-3)-167. 88p. Dep. NTIS $5.45.

The program for validating fission product transport codes utilized in the design of the high-temperature gas cooled reactor (HTGR) is described herein. The importance of fission product code verification is discussed as it relates to achieving a competitive reactor system that fully complies with federal regulations. A brief description of the RAD, PAD, and FIPER codes and their validation status is given. Individual validation tests are described in detail, including test conditions and measurements to be evaluated, and accompanying test schedules. Also included are validation schedules for each code inclusive through fiscal year 1978. Codes will be appropriately validated and utilized for fission product predictions for the Delmarva Final Safety Analysis Report (FSAR) due for release in early 1978. (auth)

13439 (HEDL-SA-938) USE OF FUEL FAILURE CORRELATIONS IN ACCIDENT ANALYSIS. O'Dell, L. D.; Baars, R. E.; Waltar, A. E. (Hanford Engineering Development Labs., Richland, Wash. (USA)). May 1975. Contract AT(45-1)-21p. (CONF-750527-6). Dep. NTIS $4.25.

From International working group on fuel failure mechanisms; Seattle, Washington, USA (11 May 1975).

The MELT-III code for analysis of a Transient Overpower (TOP) accident in an LMFBR is briefly described, including failure criteria currently applied in the code. Preliminary results of calculations exploring failure patterns in time and space in the reactor core are reported and compared for the two empirical fuel failure correlations employed in the code. (auth)

13440 (HEDL-SA-946) REVIEW OF HEDL FUEL PIN TRANSIENT ANALYSES ANALYTICAL PROGRAMS. Scott, J. H.; Baars, R. E. (comps.). (Hanford Engineering Development Lab., Richland, Wash. (USA)). May 1975. Contract AT(45-1)-2170. 28p. (CONF-750527-4). Dep. NTIS $4.50.

From international working group on fuel failure mechanisms; Seattle, Washington, USA (11 May 1975).

Methods for analysis of transient fuel pin performance are described, as represented by the steady-state SIEX code and the PECT series of codes used for steady-state and transient mechanical analyses. The empirical fuel failure correlation currently in use for analysis of transient overpower accidents is described. (auth)

13441 (KFK-2047) ON THE PROBLEM OF PIN TO PIN FAILURE PROPAGATION IN LIQUID METAL FAST BREEDER REACTORS. Jacobi, S.; Kramer, W.; Schleisiek, K. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Reaktorentwicklung; Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Schneller Brueter). Feb 1975. 28p. (In German). INIS.

A brief review of the present state of knowledge of pin to pin failure in LMFBRs is presented. Conceivable mechanisms of an accident sequence are discussed and the possibilities for a fast failure propagation are demonstrated. A pin to pin failure propagation is considered to be rather unlikely but it may not be excluded completely under certain accident conditions. (auth)

13442 (NP-20378) NUCLEAR POWER PLANT SITING: A GENERALIZED PROCESS. Calvert, J. D. Jr.; Heilman, W. L.; Smith, H. L. (Commonwealth Associates, Inc., Jackson, Mich. (USA)). Aug 1974. vp. AIF, Inc. $7.00.

From Atomic Industrial Forum, Inc.

The various siting considerations, methods of site selection and evaluation, and scope of effort employed by the electric utility industry for the siting of nuclear power plants are examined. A historical summary is given of current siting methods employed by the industry and a description of methods applicable in each stage of a generalized siting process. This process may be used by the utility industry for planning, conducting, and reporting site selection and evaluation activities. (auth)

13443 (ORNL-TM-4805(Vol.1)) QUARTERLY PROGRESS REPORT ON REACTOR SAFETY PROGRAMS SPONSORED BY THE NRC DIVISION OF REACTOR SAFETY RESEARCH FOR OCTOBER–DECEMBER 1974. I. Light-Water-Reactor Safety. (Oak Ridge National Lab., Tenn. (USA)). Apr 1975. Contract W-7405-eng-26. 126p. Dep. NTIS $5.45.

Progress is reported in the following areas of study: blowdown heat transfer; development of a fission product beta and gamma energy release program; and zirconium–water oxidation kinetics. Operations at the Nuclear Safety Information Center are reviewed. Planned multirod burst tests, LWR fuel fission product release studies, and zircaloy cladding creepdown and collapse investigations are described. (DCC)

13444 (ORNL-TM-4914(Vol.4)) REACTOR SAFETY PROGRAM SPONSORED BY THE NRC DIVISION OF REACTOR SAFETY RESEARCH. Quarterly Progress Report, January–March 1975. IV. High-Temperature Gas-Cooled Reactor Program. Sanders, J. P. (Oak Ridge National Lab., Tenn. (USA)). Jun 1975. Contract W-7405-eng-26. 20p. Dep. NTIS $4.00.

Progress is reported in the following areas: (1) HTGR systems and safety analysis and (2) computer code implementation. (JWR)

13445 (ORNL-TM-4919) MONTHLY HIGHLIGHTS FOR OFFICE OF NUCLEAR REGULATORY RESEARCH PROGRAMS AT OAK RIDGE NATIONAL LABORATORY. Fee, G. C. (comp.). (Oak Ridge National Lab., Tenn. (USA)). Mar 1975. Contract W-7405-eng-26. 40p. Dep. NTIS $5.00.

Technical highlights are briefly summarized for the following programs: heavy section steel technology; fission product beta and gamma energy release; LOCA release from LWR fuel; multi-rod burst tests; Nuclear Safety Information Center; PWR blowdown heat transfer; Zircaloy fuel cladding collapse; zirconium metal-water oxidation kinetics; transient release from LMFBR fuel; and HTGR safety analysis and research. (JWR)

13446 (SAND-75-0225) EXPERIMENTAL FAST REACTOR SAFETY RESEARCH PROGRAM. Quarterly Report, January–March 1975. (Sandia Labs., Albuquerque, N. Mex. (USA)). Apr 1975. Contract AT(29-1)-789. 87p. Dep. NTIS $7.50.

Research progress is reported for the following areas: post-accident heat removal in core debris beds; molten fuel pool studies; prompt burst excursion experiment; equation-of-state studies on reactor fuels; feasibility of high-performance fuel elements for the ACPR; and fuel notion detection studies. (JWR)

13447 (TID-26819) WATER REACTOR EVALUATION MODEL (WREM): BWR NODALIZATION AND SENSITIVITY STUDIES. (USAEC Regulatory Staff, Washington, D.C.). Oct 1974. 99p. Dep. NTIS $8.00.

Studies were performed to evaluate noding sensitivity and solution convergence for computer programs in the Water Reactor Evaluation Model. The programs are for analyzing a loss-of-coolant accident in a BWR. (JWR)

13448 (TID/SNW-107) NSS ANTICRITICALITY REQUIREMENTS FOR SPACE AND MISSION OPERATIONS. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). [nd]. 14p. Dep. NTIS $4.00.

The requirements to preclude nuclear criticality accidents during space and mission operations are considered. Possible sources of reactivity are: core compaction, external neutron reflection, control drum runout and hydrogen insertion; potential countermeasures are: poison wires, control drums locked, certain hydrogen valves locked, or limiting external neutron reflection. Of these possibilities a large hydrogen leakage or flooding can be the most serious in that control drums can be overriden. However, poison wire systems are not very practical once the reactor has been operated. Alternative methods should be investigated. (LTN)

13449 (WANL-TME-1363) REVIEW OF ASTROFUEL CRITICALITY LIMITS FOR INCREASED FUEL LOADING. Vachon, L. J.; Scarano, R. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Oct 1966. 28p. Dep. NTIS $4.50.

Declassified 11 Sep 1973.

The effect on the criticality limits imposed on the various phases of NRX-A fuel fabrication at the Astrofuel facility of increasing the fuel loading in the fabrication process has been determined for those operations where the nuclear safety design is affected by fuel loading. Reactivity calculations were made with the DTK transport code and the 16-group Hansen cross-sections which include anisotropic hydrogen scattering. The applicability of these analytical tools to NERVA criticality calculations was demonstrated in prior studies on NERVA fuel lattices. Except for the furnace fixtures, where a parametric study of the effect of fuel loading and coolant channel diameter on reactivity was carried out, a fuel loading of 600 mg U/cc was used in the analysis. As a result of the detailed analysis presented herein, it is concluded that the criticality limits and procedures currently in effect at Astrofuel are still applicable for a fuel loading of 550 mg U/cc with the exception of the annular graphitizing fixture (Type II) which exceeds the maximum acceptable reactivity ($k = 0.9$) under flooded conditions. In order to extend the process to higher loadings and/or coolant channel diameters, it will be necessary to modify the criticality design of several fixtures—either by decreasing the batch size or by incorporating nuclear poison in the fixture assembly. (auth)

13450 (WANL-TME-1413) NRX-A5 SAFETY EVALUATION REPORT. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 Aug 1966. 125p. Dep. NTIS $9.25.

Declassified 10 Sep 1973.

After a description of the NRX-A5 reactor and the test facility, the testing organization is given and responsibilities defined. The possibility of various reactor accidents is examined. Potential excursions due to core compaction, excess reflection, and physical changes in the reactor are regarded as incredible. Procedural safeguards are in effect to prevent accidental hydrogen insertion into the core, especially LH_2, mainly by isolation of the dewars by block and bleed setups. Period scrams (0.1 to 0.3 sec.), a floating power scram and a fixed power scram (twice planned power) will be active during the tests and have been found to protect the reactor by limiting potential excursions. Potential malfunctions have been analyzed, especially malfunctions leading to drum runouts, and nothing found that the control system will not take care of by reaction or by scram. Liquid hydrogen insertion, loss of turbine power, failure of coolant passages, nozzle failure, etc. are treated in detail. Fission product release from an overheated reactor is discussed. Some of these items are considered further in attached supplements and addendums. (LTN)

13451 (WANL-TNR-155) ANTICRITICALITY POISON SYSTEM (ACPS). Status Report. Lohr, E. W.; Parker, G. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 6 Mar 1964. 71p. Dep. NTIS $6.75.

Declassified 10 Sep 1973.

Concepts, designs and preliminary tests are presented for a poison wire system designed to maintain the NERVA reactor subcritical, even in the event of water flooding or high density hydrogen insertion, from manufacture to operation. Some thousands of these flexible wires are installed in the reactor coolant channels with a self-contained system for removing them through the nozzle before operation. The wires (or more likely flexible stainless tubes) contain boron-10 and are coated with teflon for low friction. The current status of the overall system and the current state of each system part are described. Five withdrawal actuator designs are compared and a detailed analysis of the most promising design (a winding tape actuator) is given. (LTN)

13452 CONTRIBUTION TO THE PROBLEMS OF METHYLIODIDE FORMATION IN NUCLEAR POWER PLANTS. Hladky, E.; Kubik, I. Bull. EGU; No. 80, 11-17(1975). (In Czech).

Knowledge of the mechanism of methyl iodide formation is summarized. On the basis of the reaction kinetics of methyl iodide formation, the program for the calculation of methyl iodide concentration is elaborated. This program was used for operating conditions at power plant A 1. Results of this calculation showed that about 30–40% of the radioiodine in coolant at A 1 can be presented as methyl iodide. Amount of methyl iodide will be increased by radiation induced formation of methyl iodide. (auth)

13453 FAST REACTOR SAFETY. Suchomel, J. Bull. EGU; No. 80, 39-44(1975). (In Czech).

A review of the present understanding of fast reactor safety is presented. Attention is focused on neutron kinetics, local failure in subassembly with a possibility of its propagation through a larger part of the core, molten fuel–sodium interaction, and containment. Impossibility of eliminating completely the probability of accidents with explosive energy release is underlined. This leads to the design of a primary containment system capable of containing the energy release. A review of current activities on fast reactor safety in the Institute is also presented. (auth)

13454 ENGINEERED SAFEGUARDS OF A PWR NUCLEAR POWER PLANT. Polak, V.; Zajic, A. Bull. EGU; No. 80, 27-33 (1975). (In Czech).

A review of the engineered safeguards for moderation and localization of design basic accident consequences at a PWR nuclear power plant is given. Attention is focused on containment systems. (auth)

13455 SAFETY OF A PWR NUCLEAR POWER PLANT. Polak, V.; Zajic, A. Bull. EGU; No. 80, 22-27(1975). (In Czech).

A review of the present understanding of safety of a PWR Nuclear Power Plant is presented. The credible accidents are described. Attention is focused on design basic accidents. A review of emergency energy sources to be considered in the course of an accident is given. (auth)

13456 IMPROVEMENT IN A SOLID-ABSORBENT SAFETY-DEVICE FOR NUCLEAR REACTORS. Malaval, C. (to Groupement pour les Activities Atomiques et Avancees (GAAA)). French Patent 2,207,329/A/. 21 Nov 1972. 12p. (In French).

Description is given of an improvement in a solid-absorbent safety-device for water-cooled reactors. That device essentially

comprises a cylindrical tank located above the reactor-core, containing a gas maintained under pressure and an absorbent in the divided form. The tank opening-means are responsive to overpressure, to shocks, and to depressurization. The tank is adapted to feed several channels simultaneously, each of which leads to a tube mounted in the reactor-core. This can be applied to pressurized light-water reactors of the PWR-type. (FR)

13457 SAFETY CRITERIA CALLED "OVERLY CONSERVATIVE". Catton, I.; Cermak, J. O.; Kuo, Y. S.; Prajoto; Wazzan, A. R. (Univ. of California, Los Angeles). Electr. World.; 183: No. 6, 84-87(15 Mar 1975).

A description is given of an analysis of the LOCA for light water reactors and the performance of emergency core-cooling systems. The evaluation focused on certain key aspects of the hypothetical LOCA and on the resultant effectiveness of ECCS. Detailed study and analyses were performed in the areas of blowdown and reflood/spray thermal and hydraulic behavior, physics of decay heat, and fuel-rod-cladding behavior with respect to metal/water reaction and embrittlement. Comparisons were also made between these analyses and those of the final acceptance criteria evaluation model specified by AEC and now in force with NRC. A partial listing of the factors that make the LOCA licensing calculations conservative is presented. (auth)

13458 EQUATION OF STATE FOR MIXED-OXIDE FAST REACTOR FUELS. Katz, M. S. Tucson, AR; Univ. of Arizona (1974). 79p. University Microfilms Order No. 75-11,465.

Thesis (Ph. D.).

An equation of state for mixed-oxide fast reactor fuels is proposed. The equation is derived for application to both the single- and the mixed-phase regions. The effects of fission products and their oxidation states are included. The equation is presented in a numerical form that is suitable for easy implementation in computer simulation of hypothetical accidents. A generalized expression is presented relating the total pressure as a function of temperature, density, burnup, and fractions of noble gases and non-gaseous fission products retained in the core. (Diss. Abstr. Int., B)

13459 NONCOHERENCE AND TWO-PHASE HEAT TRANSFER IN LMFBR FUEL-COOLANT INTERACTION. Haas, P. M.; Erdman, C. A.; Garner, P. L.; Reynolds, A. B. (Univ. of Virginia, Charlottesville). Nucl. Technol.; 26: No. 2, 146-164(Jun 1975).

Models were developed for the analysis of noncoherent mixing of fuel and sodium, reduction in two-phase heat transfer between fuel and sodium, and heat loss from sodium to cladding during a fuel-coolant interaction in a liquid-metal fast breeder reactor (LMFBR). The analysis is based on the supposition that fragmentation of molten fuel followed by its relatively rapid intimate mixing with sodium can occur in an LMFBR accident, a supposition still under widespread investigation. Calculations were made for whole-core accidents to evaluate the extent to which reductions in mechanical work might be expected from these phenomena. Although reductions in work were indicated for each phenomenon and reductions were more significant when the several phenomena were considered simultaneously, large order-of-magnitude reductions were not indicated. (auth)

13460 FUEL VAPOR GENERATION IN LMFBR CORE DISRUPTIVE ACCIDENTS. Reynolds, A. B.; Erdman, C. A.; Kirbiyik, M. (Univ. of Virginia, Charlottesville). Nucl. Technol.; 25: No. 2, 165-171(Jun 1975).

Methods to calculate bounding values for the generation of fuel vapor during disassembly and during expansion of the fuel after disassembly in a fast-reactor core-disruptive accident are discussed. Isentropic expansion of the fuel following disassembly with no fuel mixing before expansion was assumed. It was necessary to develop consistent thermodynamic fuel properties for the analysis. The method was applied to a liquid-metal fast breeder reactor disassembly, first with sodium in the core and then with sodium removed. Bounding values were also compared to lower values obtained by assuming mixing and thermal equilibrium of the fuel prior to expansion. For the bounding calculation with sodium removed, 4.6 percent of the fuel vaporized when the expanded fuel occupied all of the available volume. This value was reduced to 0.9 percent when mixing and thermal equilibrium prior to expansion was assumed. (auth)

13461 VAPOR PRESSURE MEASUREMENTS OF OXIDE FUEL BETWEEN 3000 AND 5000 K USING LASER HEATING. Bober, M.; Karow, H. U.; Schretzmann, K. (Kernforschungszentrum, Karlsruhe, Ger.). Nucl. Technol.; 26: No. 2, 237-241(Jun 1975).

Safety analysis of fast reactors requires knowledge of the vapor pressure of the fuel material under the condition of rapid heating in the temperature region from 3000 K upwards, where up to now no measured data have been available. An experimental technique to determine the vapor pressure of refractory fuel materials in the temperature range between 3000 and 5000 K is based on laser beam heating of the specimen surface for approximately 1 msec and measurement of both the recoil momentum of the specimen and the mass and momentum carried away by the vapor jet flowing into a vacuum. The determination of the vapor pressure requires application of gas dynamics and development of a suitable mode. The application limits of such a measuring technique using laser heating and the reliability of the vapor pressure data thereby determined have been assessed. (auth)

13462 SOME CONSIDERATIONS ON THE MELTING OF REACTOR FUEL PLATES AND RODS. Lahoud, A.; Boley, B. A. (University of Sherbrooke, Sherbrooke, Quebec, Canada). Nucl. Eng. Des.; 32: No. 1, 1-19(Apr 1975).

The gross melting of fuel plates and rods is discussed. The extent of melting and the rapidity with which it occurs are analyzed. Methods of analysis are presented in detail. For short times after the onset of melting, an analytical series solution is constructed by the "embedding technique". The effect of the change in density which accompanies the change in phase is examined, and is found to be relatively unimportant as far as the melting front position is concerned. An exact steady-state solution is found, which makes possible a prediction of the maximum extent of melting in cases in which steady state can be expected. The actual progress of melting for all times is more difficult to calculate, and an approximate solution is therefore introduced. Its accuracy can, in some cases, be estimated by comparison with the known final melting extent. The approximate solution is applied to a class of melting problems, and the results are presented in the form of graphs depicting the progress of the melting front for a range of parameters representing various possible conditions. (auth)

13463 DEVELOPMENT OF REAL/SYNTHETIC TIME HISTORIES TO MATCH SMOOTH DESIGN SPECTRA. Rizzo, P. C.; Shaw, D. E.; Jarecki, S. J. (E. D'Appolonia Consulting Engineers, Inc., Pittsburgh, Pennsylvania 15235, USA). Nucl. Eng. Des.; 32: No. 1, 148-155(Apr 1975).

In modern nuclear plant design there is a definite trend toward time history type analysis of equipment and structural components to determine the peak seismic response and loads. However, the site response spectra remain as the only acceptable description of expected ground motion during a seismic event. Thus, it has become necessary to develop time history accelerograms compatible with smoothed response design spectra established for a site. A new computerized technique is described for generating time history accelerogram traces from existing seismic records to match the smoothed site response spectra. The method of analysis is particularly attractive in that it minimizes man-machine interaction inherent in previous attempts to generate time histories. The program utilizes existing seismic traces represented in the frequency domain as opposed to the time domain through the use of Fourier transform techniques. (auth)

13464 NUCLEAR SAFETY IN NUCLEAR POWER AND PROPULSION DEVICES FOR SPACE. Graves, G. A. (Los Alamos Scientific Lab., NM). Astronaut. Acta; 18: No. Suppl., 99-111 (1974).

The use of nuclear devices in space systems may introduce them to a wide variety of abnormal or extreme conditions in the event of system malfunctions. Undesirable circumstances which could be encountered include explosion, fire, reentry, impact, and contact with land or water. But it does not follow that exposure to diverse and hostile environments need produce an event of nuclear consequence—i.e., one leading to significant fuel dispersal, criticality, or radiation exposure. Nuclear space systems can be studied on the ground and their nuclear safety characteristics verified or enhanced before their employment in space. Extensive research in this area has been carried on for many years in the United States and has led to the development of various means and policies through which safety is promoted or assured. These include special features in design, proscriptions on modes of operational use, and countermeasures directed at protecting against specific eventualities. Some examples of these approaches and of the research supporting them are given, and illustrative applications to isotope and reactor power supplies and to propulsion reactors are shown. (auth)

13465 FEASIBILITY OF REMOVING TRITIUM FROM NUCLEAR OFF-GAS. Belovodskii, L. F.; Gaevoi, V. K.; Grishmanovskii, V. I.; Andramanov, V. V.; Demenyuk, V. N.; Migunov, V. V. At. Energ. (USSR); 38: No. 4, 217-221(Apr 1975). (In Russian).

A method of removing tritium from gaseous waste at nuclear-energy and fuel-reprocessing plants has been proposed and experimentally verified. The method is based on catalytic tritium oxidation and HTO absorption by molecular sieves. A tritium removal

system for a catalyst volume of 2.2 litters (1.3% Pt on silica gel) permits the removal of 95.0–99.9% tritium from air and argon at 10–60 l/min pumping rate and 10^{-5}–$2.6 \cdot 10^{-1}$ Curie/l tritium concentration. The dependence of tritium removal efficiency on the catalyst volume, pumping rate, tritium concentration and off-gas composition has been investigated. On the basis of these data, commercial installations for the removal of tritium from gaseous waste can be designed. (auth)

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From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

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From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

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From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

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From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

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From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

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From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

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13494 REACTOR CAVITY PRESSURE RESPONSE TO A PIPE BREAK. Krotiuk, W. J.; Fox, J. E.; Kan, C. G. (Ebasco Services, Inc., Norcross, GA). Trans. Am. Nucl. Soc.; 21: 271-273(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13495 GENERALIZED COORDINATE TREATMENT OF THE VENT-CLEARING TRANSIENT FOR HORIZONTAL-VENT PRESSURE-SUPPRESSION CONTAINMENT SYSTEM. Lau, L. W.; Carter, J. C. (Tennessee Valley Authority, Knoxville). Trans. Am. Nucl. Soc.; 21: 273-274(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13496 COMPUTATIONAL FEATURES OF THE CACECO CONTAINMENT ANALYSIS CODE. Peak, R. D.; Stepnewski, D. D. (Westinghouse Hanford Co., Richland, WA). Trans. Am. Nucl. Soc.; 21: 274-275(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13497 SELF-ACTUATED SHUTDOWN SYSTEMS FOR LMFBR PLANTS. Huebotter, P. R.; van Erp, J. B.; Kato, W. Y.; Epstein, L. F.; Josephson, J.; Sowa, E. S.; Schumar, J. F. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 275-276(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13498 EVOLUTIONARY SAFETY DEVELOPMENTS FOR NUCLEAR POWER PLANTS. van Erp, J. B. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 277-278(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13499 HYDRODYNAMICS OF FUEL EXPANSION FOLLOWING DISASSEMBLY IN AN LMFBR CORE-DISRUPTIVE ACCIDENT. Kirbiyik, M.; Garner, P. L.; Reynolds, A. B. (Univ. of Virginia, Charlottesville). Trans. Am. Nucl. Soc.; 21: 279 (Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13500 LMFBR/HCDA ENERGY YIELD-FLUID DYNAMIC ASPECTS. Theofanous, T. G. (Purdue Univ., West Lafayette, IN); Grolmes, M. A.; Lambert, G. A.; Epstein, M. Trans. Am. Nucl. Soc.; 21: 279-280(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13501 HYDRODYNAMIC ASPECTS OF MILD LMFBR CORE DISASSEMBLY. Grolmes, M. A. (Argonne National Lab., IL); Lambert, G. A.; Theofanous, T. G. Trans. Am. Nucl. Soc.; 21: 280-281(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13502 REACTIVITY CHANGES DUE TO BUBBLE GROWTH OR COLLAPSE IN MOLTEN FUEL SYSTEMS. McLaughlin, T. P.; Turner, G. D. (Los Alamos Scientific Lab., NM). Trans. Am. Nucl. Soc.; 21: 281-282(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13503 CONSEQUENCES OF CHANNEL PLUGGING DURING FAST REACTOR OVERPOWER EXCURSIONS. Waltar, A. E.; Stewart, L. N.; Wilburn, N. P.; Padilla, A. Jr. (Westinghouse Hanford Co., Richland, WA). Trans. Am. Nucl. Soc.; 21: 281-282(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13504 IMPORTANCE OF DISPERSAL AND FLUIDIZATION IN ASSESSING RECRITICALITY IN LMFBR CORE DISRUPTIVE ACCIDENTS. Fauske, H. K. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 283-284(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13505 FX2POOL: A DYNAMIC TWO-DIMENSIONAL MULTI-FLUID HYDRO/THERMODYNAMIC AND NEUTRONICS MODEL FOR BOILING POOLS. Abramson, P. B. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 284-286(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13506 TREAT LOSS-OF-FLOW SAFETY EXPERIMENT R6. Spencer, B. W.; Holtz, R. E.; Testa, F. J. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 287-288(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13507 FUEL MOVEMENT IN R3, R5, AND R6 LOSS-OF-COOLANT SIMULATIONS IN TREAT. De Volpi, A.; Rhodes, E.; Holtz, R.; Regis, J.; Stewart, R. R. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 288(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13508 CALIBRATION AND AXIAL POWER-SHAPING EXPERIMENTS IN TREAT FOR LOSS-OF-FLOW TESTS WITH THE MARK-IIC INTEGRAL SODIUM LOOP. Simms, R.; Kolba, V. M.; McVean, R. L.; Rothman, A. B.; Villarreal, R. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 288-289(Jun 1975).
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13509 LOSS-OF-FLOW TEST L5 ON FFTF-TYPE IRRADIATED FUEL. Simms, R.; Kolba, V. M.; Lo, R. K.; Purviance, R. T.; Rothman, A. B.; Tyika, J. P. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 289-290(Jun 1975).
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13510 TRANSIENT OVERPOWER TEST E8 ON FFTF-TYPE LOW-POWER IRRADIATED FUEL. Simms, R.; Burelback, J. P.; Lo, R. K.; Rothman, A. B.; Schmidt, K. J.; Tylka, J. P. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 290-291(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13511 EFFECTS OF LMFBR OXIDE FUEL PRECONDITIONING ON TREAT REACTOR SAFETY TEST RESULTS. Dickerman, C. E. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 291-293(Jun 1975).
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13512 SLSF SIMULATION OF AN LMFBR HYPOTHETICAL LOSS-OF-PIPING-INTEGRITY ACCIDENT. Marr, W. W.; Hwang, I. T.; Bezella, W. A.; Tessier, J. H.; Thompson, D. H. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 293-294(Jun 1975).
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From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

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From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

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From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

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13495 GENERALIZED COORDINATE TREATMENT OF THE VENT-CLEARING TRANSIENT FOR HORIZONTAL-VENT PRESSURE-SUPPRESSION CONTAINMENT SYSTEM. Lau, L. W.; Carter, J. C. (Tennessee Valley Authority, Knoxville). Trans. Am. Nucl. Soc.; 21: 273-274(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13496 COMPUTATIONAL FEATURES OF THE CACECO CONTAINMENT ANALYSIS CODE. Peak, R. D.; Stepnewski, D. D. (Westinghouse Hanford Co., Richland, WA). Trans. Am. Nucl. Soc.; 21: 274-275(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13497 SELF-ACTUATED SHUTDOWN SYSTEMS FOR LMFBR PLANTS. Huebotter, P. R.; van Erp, J. B.; Kato, W. Y.; Epstein, L. F.; Josephson, J.; Sowa, E. S.; Schumar, J. F. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 275-276(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13498 EVOLUTIONARY SAFETY DEVELOPMENTS FOR NUCLEAR POWER PLANTS. van Erp, J. B. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 277-278(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13499 HYDRODYNAMICS OF FUEL EXPANSION FOLLOWING DISASSEMBLY IN AN LMFBR CORE-DISRUPTIVE ACCIDENT. Kirbiyik, M.; Garner, P. L.; Reynolds, A. B. (Univ. of Virginia, Charlottesville). Trans. Am. Nucl. Soc.; 21: 279 (Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13500 LMFBR/HCDA ENERGY YIELD-FLUID DYNAMIC ASPECTS. Theofanous, T. G. (Purdue Univ., West Lafayette, IN); Grolmes, M. A.; Lambert, G. A.; Epstein, M. Trans. Am. Nucl. Soc.; 21: 279-280(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13501 HYDRODYNAMIC ASPECTS OF MILD LMFBR CORE DISASSEMBLY. Grolmes, M. A. (Argonne National Lab., IL); Lambert, G. A.; Theofanous, T. G. Trans. Am. Nucl. Soc.; 21: 280-281(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13502 REACTIVITY CHANGES DUE TO BUBBLE GROWTH OR COLLAPSE IN MOLTEN FUEL SYSTEMS. McLaughlin, T. P.; Turner, G. D. (Los Alamos Scientific Lab., NM). Trans. Am. Nucl. Soc.; 21: 281-282(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13503 CONSEQUENCES OF CHANNEL PLUGGING DURING FAST REACTOR OVERPOWER EXCURSIONS. Waltar, A. E.; Stewart, L. N.; Wilburn, N. P.; Padilla, A. Jr. (Westinghouse Hanford Co., Richland, WA). Trans. Am. Nucl. Soc.; 21: 281-282(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13504 IMPORTANCE OF DISPERSAL AND FLUIDIZATION IN ASSESSING RECRITICALITY IN LMFBR CORE DISRUPTIVE ACCIDENTS. Fauske, H. K. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 283-284(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13505 FX2POOL: A DYNAMIC TWO-DIMENSIONAL MULTI-FLUID HYDRO/THERMODYNAMIC AND NEUTRONICS MODEL FOR BOILING POOLS. Abramson, P. B. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 284-286(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13506 TREAT LOSS-OF-FLOW SAFETY EXPERIMENT R6. Spencer, B. W.; Holtz, R. E.; Testa, F. J. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 287-288(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13507 FUEL MOVEMENT IN R3, R5, AND R6 LOSS-OF-COOLANT SIMULATIONS IN TREAT. De Volpi, A.; Rhodes, E.; Holtz, R.; Regis, J.; Stewart, R. R. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 288(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13508 CALIBRATION AND AXIAL POWER-SHAPING EXPERIMENTS IN TREAT FOR LOSS-OF-FLOW TESTS WITH THE MARK-IIC INTEGRAL SODIUM LOOP. Simms, R.; Kolba, V. M.; McVean, R. L.; Rothman, A. B.; Villarreal, R. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 288-289(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13509 LOSS-OF-FLOW TEST L5 ON FFTF-TYPE IRRADIATED FUEL. Simms, R.; Kolba, V. M.; Lo, R. K.; Purviance, R. T.; Rothman, A. B.; Tylka, J. P. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 289-290(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13510 TRANSIENT OVERPOWER TEST E8 ON FFTF-TYPE LOW-POWER IRRADIATED FUEL. Simms, R.; Burelback, J. P.; Lo, R. K.; Rothman, A. B.; Schmidt, K. J.; Tylka, J. P. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 290-291(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13511 EFFECTS OF LMFBR OXIDE FUEL PRECONDITIONING ON TREAT REACTOR SAFETY TEST RESULTS. Dickerman, C. E. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 291-293(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13512 SLSF SIMULATION OF AN LMFBR HYPOTHETICAL LOSS-OF-PIPING-INTEGRITY ACCIDENT. Marr, W. W.; Hwang, I. T.; Bezella, W. A.; Tessier, J. H.; Thompson, D. H. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 293-294(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13513 RESPONSE OF THE GAS-COOLED FAST BREEDER REACTOR TO FLOW REDUCTION ACCIDENTS. Buttemer, D. R.; Torri, A. (General Atomic Co., San Diego, CA). Trans. Am. Nucl. Soc.; 21: 295(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13514 LOSS-OF-FLOW ACCIDENT PHENOMENOLOGY IN THE GCFR. Torri, A.; Buttemer, D. R. (General Atomic Co., San Diego, CA). Trans. Am. Nucl. Soc.; 21: 295-296(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13515 CORE DISRUPTIVE ACCIDENT ANALYSIS OF A GAS-COOLED FAST BREEDER REACTOR. Alcouffe, R. E. (Nuclear Regulatory Commission, Washington, DC); Ludewig, H. Trans. Am. Nucl. Soc.; 21: 296-297(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13516 ANALYSIS OF LOSS-OF-FLOW ACCIDENTS FOR THE SNR-300 MARK 1A CORE. Froehlich, R. (Kernforschungszentrum, Karlsruhe, Ger.); Royl, P.; Schmuck, P.; Duesing, R.; Senglaub, M. Trans. Am. Nucl. Soc.; 21: 297-298(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13517 LOSS-OF-FLOW COMPARISON SAFETY STUDIES FOR 1000-MW(e) OXIDE AND CARBIDE FAST BREEDER REACTORS. Bowers, C. H. (Argonne National Lab., IL); Bleiweis, P. B. Trans. Am. Nucl. Soc.; 21: 298-299(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13518 CODE FOR ANALYZING PARALLEL-CHANNEL THERMAL-HYDRAULICS IN EBR-II DURING NATURAL CONVECTION CONDITIONS (THE CONVECT CODE). Mohr, D.; Gillette, J. L. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 299-300(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13519 FLOW-CONTROLLED COASTDOWN TESTS TO BOILING IN A SODIUM-COOLED 19-ROD BUNDLE. Wantland, J. L.; Fontana, M. H.; Gnadt, P. A.; Kress, T. S.; MacPherson, R. E.; Parsly, L. F. (Oak Ridge National Lab., TN). Trans. Am. Nucl. Soc.; 21: 300-301(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13520 MECHANISTIC APPROACH TO LMFBR CLADDING FAILURE PREDICTION IN TRANSIENT OVERPOWER EXPERIMENTS. Atcheson, D. B.; Sherry, R. R. (General Electric Co., Sunnyvale, CA). Trans. Am. Nucl. Soc.; 21: 302(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13521 FAILURE OF IRRADIATED LMFBR FUEL PINS IN A TRANSIENT OVERPOWER ACCIDENT. Majumdar, D.; Judd, A. M. (Brookhaven National Lab., Upton, NY). Trans. Am. Nucl. Soc.; 21: 302-303(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13522 FAILURE THRESHOLD CORRELATION FOR FAST REACTOR TRANSIENT OVERPOWER ACCIDENT ANALYSIS. Baars, R. E.; Scott, J. H.; Culley, G. E. (Westinghouse Hanford Co., Richland, WA). Trans. Am. Nucl. Soc.; 21: 303-305(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13523 THERMAL INTERACTION OF MOLTEN CARBIDE FUEL WITH STAINLESS-STEEL CLADDING. Sullivan, J. E. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 305-306(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13524 FUEL BEHAVIOR SLIGHTLY ABOVE OR BELOW THE FAILURE THRESHOLD. Wrona, B. J.; Galvin, T. M. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 306-307(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13525 OUT-OF-REACTOR FUEL-MOTION STUDIES UTILIZING DIRECT ELECTRICAL HEATING. Wrona, B. J.; Galvin, T. M. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 307-308(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13526 POST-ACCIDENT HEAT REMOVAL WITH ADVANCED LMFBR FUELS. Gasser, R. D., (Brookhaven National Lab., Upton, NY); Catton, I.; Kastenberg, W. E. Trans. Am. Nucl. Soc.; 21: 309(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13527 CORE-DEBRIS RETENTION IN THE BELOW-CORE STRUCTURE FOLLOWING AN LMFBR DISASSEMBLY. Cheung, F. B.; Baker, L. Jr. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 309-310(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13528 POST-ACCIDENT DOWNWARD FUEL RELOCATION IN THE LMFBR. Gasser, R. D.; Kazimi, M. S. (Brookhaven National Lab., Upton, NY). Trans. Am. Nucl. Soc.; 21: 310-311 (Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13529 MELTING RATES FOR THE ATTACK OF STEEL STRUCTURE BY UO_2 FUEL OR STEEL VAPOR. Epstein, M.; Cho, D. H. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 311-312(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13530 PROPAGATION OF HCDA PRESSURE PULSES IN A PLASTICALLY DEFORMING PIPING LOOP. Moneim, M. T. A.; Chang, Y. W. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 312-313(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13531 RESPONSE OF A HEXAGONAL FUEL SUBASSEMBLY WALL DUE TO AN AXISYMMETRIC PRESSURE SOURCE. Marchertas, A. H.; Julke, R. T. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 313-314(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13532 ASSESSMENT OF LOCAL BLOCKAGES IN CARBIDE ASSEMBLIES. Siegmann, E. R.; Gilbertson, J. C. (Combustion Engineering, Inc., Windsor, CT). Trans. Am. Nucl. Soc.; 21: 315(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13533 RATE OF COOLANT RECOVERY FOLLOWING RAPID RELEASE OF FISSION GAS FROM A POSTULATED MULTIPLE PIN FAILURE IN AN LMFBR SUBASSEMBLY. Chawla, T. C.; Fauske, H. K.; Hauser, G. M.; Grolmes, M. A. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 315-317(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13534 TEMPERATURE NOISE MEASUREMENTS IN BLOCKED AND UNBLOCKED 19-PIN ELECTRICALLY HEATED LMFBR FUEL SUBASSEMBLY MOCKUPS. Fry, D. N. (Oak Ridge National Lab., TN). Trans. Am. Nucl. Soc.; 21: 317-318(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13535 EFFECT OF POSTULATED GAS BUBBLE PASSAGE THROUGH CRBR CORE. Coffield, R.; Coldewey, R.; Mayo, W. (Westinghouse Electric Corp., Madison, PA). Trans. Am. Nucl. Soc.; 21: 318-319(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13536 PRELIMINARY ASSESSMENT OF SUBASSEMBLY-TO-SUBASSEMBLY PROPAGATION IN LMFBRs. Fauske, H. K. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 319-320 (Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13537 INTERNAL FUEL MOTION DURING FAST REACTOR OVERPOWER TRANSIENTS. Padilla, A. Jr. (Westinghouse Hanford Co., Richland, WA). Trans. Am. Nucl. Soc.; 21: 321(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13538 INSTANTANEOUS INTERFACE TEMPERATURE OF SUDDENLY CONTACTING UO_2 AND SODIUM. Kazimi, M. S. (Brookhaven National Lab., Upton, NY). Trans. Am. Nucl. Soc.; 21: 321-322(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13539 COMMENTS ON CLADDING AND EARLY FUEL RELOCATION IN LMFBR CORE DISRUPTIVE ACCIDENTS. Fauske, H. K. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 322-323(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13540 CALCULATIONAL METHOD FOR TRANSIENT RADIATION HEAT TRANSFER IN AN ABSORBING-EMITTING MEDIUM AND ITS APPLICATION TO LMFBR ACCIDENT ANALYSIS. Chan, S. H.; Cho, D. H. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 323-324(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13541 FOG FORMATION IN HYPOTHETICAL LMFBR ACCIDENTS. Epstein, M.; Cho, D. H. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 324-325(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13542 PREDICTION OF ONSET OF ENTRAINMENT FOR LIQUID METALS. Ishii, M.; Grolmes, M. A. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 325-326(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13543 HYDRODYNAMICALLY CONTROLLED REWETTING IN REACTOR CORE COOLING. Chan, S. H.; Grolmes, M. A. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 333-334(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13544 USE OF VERTICAL SLIP FLOW AND FLOODING MODELS IN LOCA ANALYSIS. Fischer, S. R. (Aerojet Nuclear Co., Idaho Falls, ID). Trans. Am. Nucl. Soc.; 21: 334-335(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13545 PREDICTION OF ECC INJECTION SECTION PRESSURE DIFFERENTIAL DURING A LOCA. Robinson, R. A.; Cudnik, R. A. (Battelle Columbus Labs., OH). Trans. Am. Nucl. Soc.; 21: 335-336(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13546 ASPECTS OF POST-LOCA CONTAINMENT PRESSURE TEMPERATURE ANALYSIS. Almenas, K.; Lee, U. C.; Crane, A. (Univ. of Maryland, College Park). Trans. Am. Nucl. Soc.; 21: 336-337(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13547 STUDIES OF STEAM–WATER INTERACTIONS IN THE DOWNCOMER OF A 1/15-SCALE REPRESENTATION OF A FOUR-LOOP PWR. Cudnick, R. A.; Flanigan, L. J.; Wooton, R. O. (Battelle Columbus Labs., OH). Trans. Am. Nucl. Soc.; 21: 337-339(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13548 THERMAL-HYDRAULIC ANALYSIS OF THE FIRST SEMISCALE MOD-1 TEST SERIES. Mecham, D. C.; Cartmill, C. E. (Aerojet Nuclear Co., Idaho Falls, ID). Trans. Am. Nucl. Soc.; 21: 339-340(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13549 ANALYSIS OF A PWR VESSEL RUPTURE USING COMPUTER CODES RELAP-3 AND RELAP-4. Hughes, G. A.; Loyalka, S. K.; Meyer, W. (Univ. of Missouri, Columbia). Trans. Am. Nucl. Soc.; 21: 341(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13550 SENSITIVITY ASSESSMENTS FOR REACTOR SAFETY STUDIES. Kelly, J. E.; McCormick, N. J.; Erdmann, R. C. (Science Applications, Inc., La Jolla, CA). Trans. Am. Nucl. Soc.; 21: 342-343(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13551 RAPID DEPRESSURIZATION OF DRYWELL. Hammersley, Crawford, R. M. (Sargent and Lundy Engineers, Chicago). Trans. Am. Nucl. Soc.; 21: 343-344(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13552 EFFECTIVENESS OF CONTAINMENT SPRAY SYSTEMS. Chung, J. N.; Loyalka, S. K. (Univ. of Missouri, Columbia). Trans. Am. Nucl. Soc.; 21: 344-345(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13553 ANALYSIS OF SUBCOOLED WATER BLOWDOWN FORCES. Jain, R. D.; Hastings, G. A. (Bechtel Corp., San Francisco). Trans. Am. Nucl. Soc.; 21: 345-346(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13554 BWR BLOWDOWN HEAT TRANSFER EXPERIMENT. Sutherland, W. A.; Lahey, R. T. (General Electric Co., San Jose, CA). Trans. Am. Nucl. Soc.; 21: 345-346(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13555 RESPONSE OF THE CURRENT PWR DESIGN TO ATWS CONDITIONS. LaBelle, D. W.; Russell, C. D. (Babcock and Wilcox Co., Lynchburg, VA). Trans. Am. Nucl. Soc.; 21: 347-348 (Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13556 GENERALIZED METHODOLOGY FOR THE PROBABILISTIC ASSESSMENT OF AIRCRAFT CRASH ON NUCLEAR POWER PLANTS. Godbout, P. J.; Houle, J. L.; Moore, M.; Brais, A. (Univ. of Montreal). Trans. Am. Nucl. Soc.; 21: 349-350(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13557 HAZARDS TO NUCLEAR STATIONS FROM EXPLOSIVE GAS MIXTURES: A METHODOLOGY. Iotti, R. C.; DeBoisblanc, D. R.; Wiley, R.; Krotiuk, W. J. (Ebasco Services, Inc., Norcross, GA). Trans. Am. Nucl. Soc.; 21: 350-351(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13558 DESIGN BASIS VELOCITIES OF TORNADO-GENERATED MISSILES. Iotti, R. C. (Ebasco Services, Inc., Norcross, GA). Trans. Am. Nucl. Soc.; 21: 351-353(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13559 PARAMETRIC STUDY OF THE BASIC FUNCTIONS DETERMINING TURBINE MISSILE DAMAGE. Swan, S. W.; Meleis, M. (Bechtel Corp., San Francisco). Trans. Am. Nucl. Soc.; 21: 353-354(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13560 CALCULATION OF STRIKE PROBABILITIES AND ENERGY RANGES OF TURBINE MISSILES INCLUDING THE EFFECT OF MISSILE-BARRIER INTERACTIONS. Johnson, B. (Science Applications, Inc., La Jolla, CA); Gilbert, K.; Hanst, J.; Walker, D. Trans. Am. Nucl. Soc.; 21: 355(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13561 ANALYSIS OF COMPRESSIBLE GAS DISCHARGE FORCING LIQUID THROUGH AN ORIFICE. Augustine, G. L. (Westinghouse Electric Corp., Pittsburgh); Hwang, C. C. Trans. Am. Nucl. Soc.; 21: 397-398(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13562 HOW PROTECTIVE CLOTHING AFFECTS THE PRODUCTIVITY OF "HOT" MAINTENANCE PERSONNEL. Hensler, W. J. (Florida Power and Light Co., Miami). Trans. Am. Nucl. Soc.; 21: 443-444(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13563 ACCURACY OF COARSE-MESH THREE-DIMENSIONAL CALCULATIONS FOR QUASISTATIC FAST REACTOR TRANSIENT

ANALYSIS. Nelson, J. V.; Hardie, R. W. (Westinghouse Hanford Co., Richland, WA). Trans. Am. Nucl. Soc.; 21: 475(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13564 SODIUM BOILING DETECTION IN LMFBRS BY ACOUSTIC-NEUTRONIC CROSS CORRELATION. Wright, S. A.; Albrecht, R. W. (Univ. of Washington, Seattle). Trans. Am. Nucl. Soc.; 21: 478-479(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13565 DESIGN FEATURES TO REDUCE OCCUPATIONAL DOSE. Vanasse, R. E.; DiSabatino, A. A. Jr. (Stone and Webster Engineering Corp., Boston). Trans. Am. Nucl. Soc.; 21: 510-512 (Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13566 ARCHITECT/ENGINEER BALANCE-OF-PLANT RADIOLOGICAL DESIGN CONSIDERATIONS. Piccot, A. R. (Sargent and Lundy Engineers, Chicago). Trans. Am. Nucl. Soc.; 21: 512(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13567 CONTROL OF OCCUPATIONAL RADIATION EXPOSURES IN TVA NUCLEAR POWER PLANTS: DESIGN AND OPERATING PHILOSOPHY. Stone, G. F.; Beasley, E. G.; Zobel, W.; Belvin, E. A.; Lyon, M. (Tennessee Valley Authority, Chattanooga). Trans. Am. Nucl. Soc.; 21: 512-513(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13568 MINIMIZING RADIATION EXPOSURES IN PWR PLANTS. Clemons, L. Jr.; Battaglia, J. (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc.; 21: 513-514 (Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13569 POTENTIAL ROLE OF STANDARDS IN CALCULATING RADIOACTIVITY EFFECTS. McFarlane, A. F. (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc.; 21: 518-520(Jun 1975).
From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13570 SAFETY ASPECTS OF HTR'S. Mancini, G.; Del Beccaro, R.; Ashworth, F. P. O. pp 80.1-80.6 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).
From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.
The safety characteristics of the High Temperature Reactor have been analysed with particular regard to the fuel performance. The accidents and malfunctions that can occur in an HTR system have been broadly ranked in two categories: those which can effect the system availability and those which can jeopardise the ultimate public safety. Availability and safety are the two parameters for optimisation of the system. The fuel duty and performance has been examined in this light and the requirements for secondary barriers explained; certain different fuel and fission product managements and also different national regulatory policies play an important role in the ultimate decision. A general trend has been confirmed in that the fuel performance mostly affects the system availability whereas the safety is more dependent on the plant characteristics. Finally the fuel aspects that need more research and testing have been outlined. 6 references. (auth)

13571 SAFETY ASPECTS OF THE ADVANCED GAS COOLED REACTOR. Beswick, T. C. (Central Electric Generating Board, Berkeley, Eng.). pp 81.1-81.6 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).
From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.
Following a discussion of radiological design criteria for both normal operation and fault conditions, some limitations on fuel design and operating conditions are mentioned. General principles for reactor shutdown and post trip cooling systems are described and the integrity of the pressure circuit discussed. The consequences of a few typical pressurised faults and a typical maximum credible depressurisation accident are described. (auth)

13572 PROBLEMS IN THE SEPARATION OF RADIOACTIVE IODINE IN THE NEIGHBOURHOOD OF THE REACTOR. Pecornik, D. (Brown, Boveri und Cie A. G., Mannheim (F. R. Germany)). At. Strom; 21: No. 3/4, 22-25(Mar 1975). (In German).
6 figs.; 8 refs.
The problems concerning the separation of radioactive iodine from the contaminated reactor exhaust gases are described. Method for reduction of radioactive iodine to a permissible level before release into the atmosphere are examined. (auth)

Reactor Theory and Calculation

Refer also to abstracts 12736, 13247, and 13660.

13573 (DP-MS-75-3) COARSE-MESH FOR TWO-DIMENSIONAL, MIXED-LATTICE DIFFUSION THEORY CALCULATIONS. Dodds, H. L. Jr.; Honeck, H. C.; Hostetler, D. E. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). 1975. Contract AT(07-2)-1. 11p. (CONF-750624-5). Dep. NTIS $4.00.
From American Nuclear Society meeting; New Orleans, Louisiana, USA (8 Jun 1975).
A coarse-mesh (CM) finite-difference method has been developed for two-dimensional diffusion calculations in hexagonal geometry. Results obtained with the CM method have been compared with conventional finite-difference (CFD) results and with experimental results. The results of this work support the following conclusions: (1) The accuracy of the CM method with 1 point/hex is about the same as the CFD method with 3 or 6 points/hex, depending on the problem being solved. (2) The computing costs, core storage, and CPU time of the CM method with 1 point/hex are about the same as the CFD method with 1 point/hex. (auth)

13574 (JUL-1147-RG) TREATMENT OF ANISOTROPIC NEUTRON SCATTERING IN NUMERICAL REACTOR PHYSICS. Brockmann, H. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorentwicklung). Dec 1974. 45p. INIS.
In many problems of reactor physics anisotropic scattering of neutrons in the high energy range has an important influence on the neutron transport through matter. To take this fact into account in neutronic calculations computer codes based on the Monte Carlo method and on the method of discrete ordinates are used. The different techniques for the handling of anisotropic scattering in these transport codes are described and discussed. For a comparison of the different methods the neutron flux distribution in a simple assembly consisting of natural lithium is investigated by three computer codes: A modified version of the Monte Carlo code ESP, the discrete ordinates transport code ANISN, and the multigroup Monte Carlo code MORSE which uses the same group cross sections as ANISN. In general, the agreement between the different codes is good; even better than one would expect from the approximations made in the codes ANISN and MORSE. Some discrepancies occur at the inner and outer boundary of the assembly; but it cannot be concluded that these are due to an incorrect handling of anisotropic scattering in some of the codes. (auth)

13575 NEW ITERATIVE SCHEME OF MULTIGROUP CALCULATION OF NUCLEAR REACTORS. Nikolaishvilli, Sh. S.; Peradze, R. K. Soobshch. Akad. Nauk Gruz. SSR; 78: No. 1, 17-20(Apr 1975). (In Russian).
A new iterative procedure for multigroup calculation of nuclear reactors is suggested. The convergence of iterations is proved and the rate of convergence is estimated. The new scheme allows simple use of the computer. (auth)

13576 DETERMINATION OF WALL-FLUID TEMPERATURE HEAD IN REACTOR THERMAL CALCULATIONS. Gubarev, V. A.; Trofimov, A. S. Sov. At. Energy (Engl. Transl.); 37: No. 3, 966-969(Sep 1974).
Translated from At. Energ. (USSR); 37: No. 3, 251-253(Sep 1974).
A method for the treatment of thermal instabilities in fuel channels due to the uneven heat flux over the length of the channel is presented. (JWR)

13577 TIME OPTIMAL SPATIAL OFFSET CONTROL IN NUCLEAR POWER REACTORS. El-Bassioni, A. A.; Poncelet, C. G. (Carnegie-Mellon Univ., Pittsburgh). Ann. Nucl. Sci. Eng.; 1: No. 11/12, 529-536(Nov 1974).
The problem of minimal time control of xenon spatial oscillations in nuclear power reactors is investigated, and the effect of constraints on the control variable (rod position), spatial offset magnitude, and rate of change, which is closely related to the rate of change of the local power density, is studied. The concept of spatial offset phase plane is extended to include direct reference to the measured spatial offset. The optimal constrained and unconstrained trajectories and switching curves are analyzed in the phase plane. Work done on the Carnegie-Mellon University digital reactor simulator confirmed the success of the derived

theoretical results. Operational strategies that embody both the strength of the theory and the simplicity needed for practical application are recommended. (auth)

13578 APPLICATION OF FEW-GROUP METHODS TO CALCULATE FAST REACTOR PHYSICAL CHARACTERISTICS. Karpov, V. A.; Matveev, V. I.; Gobatov, N. E.; Averin, L. V.; Chernyi, V. A.; Samsonov, V. G. At. Energ. (USSR); 38: No. 4, 213-216(Apr 1975). (In Russian).

Experience gained in the application of few-group methods for calculation of fast reactors in two-dimensional hexagonal geometry is described. Basic information on algorithms and calculation codes used is presented. The effect of number and boundaries of energy groups on calculation accuracy of basic physical characteristics is examined. It is shown that the two-group approximation is of acceptable accuracy. Calculated and experimental quantities for critical assembly of a BN-600 reactor model are compared. (auth)

13579 ADVANCED NUCLEAR-REACTOR SIMULATION TECHNIQUES. Jimenez, R. F. (Washington Public Power Supply System, Richmond); Benham, R. D. Simulation.; 24: No. 3, 87-94(Mar 1975).

Single-point kinetic and thermodynamic equations for nuclear reactors which are typically used in safety-analysis studies are presented. The studies were performed on 4K PDP 8 and the larger PDP 11/20 computers with Interactive Simulation Language (ISL). The parameters of a former LOFT Reactor design are used, but the delayed-neutron fractions and decay constants are taken from a paper by Albrecht and Metelmann. Simulations are made for six, three, two, and one delayed neutron group for a startup accident. The purpose of the runs is to show the effect of simplifying assumptions on accuracy and on the speed of computer processing. The results show that speed can be increased by a factor of 20 without seriously affecting accuracy. At these speeds, it is possible to simulate the nuclear system five times faster than real time on a PDP 11/20 computer. With extra hardware such as a mul/div unit or a floating-point processor, additional speed is possible. (auth)

13580 MOTION PICTURE ON APPROACH TO CRITICALITY AND REACTOR DYNAMICS. Jones, R. B. (Univ. of California, Santa Barbara); Tavel, M. A. Trans. Am. Nucl. Soc.; 21: 78-79 (Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13581 PARTIAL IMPLICIT CHARACTERISTIC METHOD FOR ONE-DIMENSIONAL FLUID FLOW. Takeuchi, J.; Gurcak, A. W. Jr. (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc.; 21: 199-200(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13582 ROLE OF THE MIGRATION AREA IN LATTICE REACTIVITY CALCULATIONS. Gelbard, E. M. (Argonne National Lab., IL); Leil, R. Trans. Am. Nucl. Soc.; 21: 222(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13583 COARSE-MESH METHOD FOR TWO-DIMENSIONAL MIXED-LATTICE DIFFUSION THEORY CALCULATIONS. Dodds, H. L. Jr.; Honeck, H. C.; Hostetler, D. E. (E. I. du Pont de Nemours and Co., Aiken, SC). Trans. Am. Nucl. Soc.; 21: 223-224(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13584 IMPLICIT MATRIX DECOMPOSITION SCHEME FOR COARSE-MESH METHODS. Langenbuch, S.; Werner, W. (Technische Univ., Munich). Trans. Am. Nucl. Soc.; 21: 224(Jun 1975)

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13585 ENERGY-DEPENDENT FINITE ELEMENT METHOD FOR FEW-GROUP DIFFUSION EQUATIONS. Walters, W. F.; Komoriya, H. (Univ. of Delaware, Newark). Trans. Am. Nucl. Soc.; 21: 224-225(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13586 TWO-DIMENSIONAL MULTIGROUP TRANSPORT CALCULATIONS USING PHASE-SPACE FINITE ELEMENTS. Yuan, Y. C.; Lewis, E. E. (Northwestern Univ., Evanston, IL). Trans. Am. Nucl. Soc.; 21: 227(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13587 INTEGRAL TRANSPORT THEORY WITH CELL COUPLINGS INVOLVING ARBITRARILY DISTRIBUTED CURRENTS. Jonsson, A. (A. J. Reaktor-Fysik AB, Hallefors, Sweden); Goldstein, R.; Mockel, Andre. Trans. Am. Nucl. Soc.; 21: 231-233(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13588 RELATIONSHIP OF OBSERVED FLOW PATTERNS TO GAS-CORE REACTOR CRITICALITY. Macbeth, P. J. (Aerojet Nuclear Co., Idaho Falls, ID); Kunze, J. F.; Rogers, V. C. Trans. Am. Nucl. Soc.; 21: 424-426(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13589 EFFECT OF FUEL BURNUP ON THE TRANSIENT BEHAVIOR OF FAST REACTORS. Idberg, D.; Saphier, D.; Yiftah, S. (Soreq Nuclear Research Center, Yavne, Israel). Trans. Am. Nucl. Soc.; 21: 463-464(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13590 PRIMARY FISSION PRODUCT YIELDS FOR ANALYSIS OF AFTERHEAT. Liaw, J. R.; Spinrad, B. I. (Oregon State Univ., Corvallis). Trans. Am. Nucl. Soc.; 21: 473-474(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13591 SPACE–TIME SOLUTIONS OF NONLINEAR REACTOR DYNAMICS BY FINITE ELEMENT METHOD (FEM). Nguyen, D. H. (Naval Postgraduate School, Monterey, CA). Trans. Am. Nucl. Soc.; 21: 475-477(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13592 NUCLEATE BOILING DYNAMICS WITH FORCED CONVECTION. Peterson, W. C. (North Carolina State Univ., Raleigh); Zaalouk, M. G. Trans. Am. Nucl. Soc.; 21: 477-478 (Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13593 REACTOR KINETICS WITH TIME-DEPENDENT INHOUR MODES AND ADJOINTS. Trombetti, T. (CNEN, Bologna). Trans. Am. Nucl. Soc.; 21: 480-481(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13594 REACTOR STABILITY IN THE NODAL APPROXIMATION. Trombetti, T. (CNEN, Bologna). Trans. Am. Nucl. Soc.; 21: 481-482(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13595 ROLES OF INTEGRAL AND DIFFERENTIAL EXPERIMENTS IN REACTOR DEVELOPMENT. Yeater, M. (Rensselaer Polytechnic Inst., Troy, NY). Trans. Am. Nucl. Soc.; 21: 483(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13596 METHOD FOR CALCULATING THE ABSORPTION IN THE 1-eV RESONANCE OF ^{240}Pu IN WATER LATTICES. Buslik, A. J. (Brookhaven National Lab., Upton, NY). Trans. Am. Nucl. Soc.; 21: 492(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13597 INTERMEDIATE RESONANCE ABSORPTION INCLUDING INTERFERENCE SCATTERING AND DOPPLER BROADENING. Goldstein, R. (Combustion Engineering, Inc., Windsor, CT). Trans. Am. Nucl. Soc.; 21: 493-494(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13598 ENERGY-DEPENDENT FINE-STRUCTURE EFFECTS ON DOPPLER WORTH. Karni, Y.; Greenspan, E. (Atomic Energy Commission, Beer-Sheva, Israel). Trans. Am. Nucl. Soc.; 21: 494-495(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13599 SELF-SHIELDING OF ELASTIC TRANSFER MATRICES. MacFarlane, R. E. (Los Alamos Scientific Lab., NM); Becker, M. Trans. Am. Nucl. Soc.; 21: 495-496(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13600 NEUTRON SLOWING IN FINITE HYDROGEN MODERATOR. Murray, R. L.; Causey, R. A. (North Carolina State Univ., Raleigh). Trans. Am. Nucl. Soc.; 21: 496(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13601 ITERATIVE CONVERGENCE TO CONTINUOUS DOMINANT EIGENFUNCTION IN THREE DIMENSIONAL NEUTRON TRANSPORT. Premuda, F. (CNEN, Bologna); Spiga, G. Trans. Am. Nucl. Soc.; 21: 499-500(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13602 CALCULATIONAL UNCERTAINTIES BY MONTE CARLO METHODS. Mingle, J. O. (Kansas State Univ., Manhattan). Trans. Am. Nucl. Soc.; 21: 500(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13603 GENERALIZED FLARE-TYPE NODAL EQUATION. Shimooke, T. (Japan Atomic Energy Research Inst., Ibaraki). Trans. Am. Nucl. Soc.; 21: 501-502(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13604 NUCLEAR-REACTOR ANALYSIS. Henry, A. F. Cambridge, MA; Massachusetts Institute of Technology Press (1975). 556p. $35.00.

Chapters are included on the following: the goal of reactor physics calculations; reaction rates; energy distribution of neutrons in an infinite, homogeneous, critical reactor; diffusion theory; the determination of energy-group constants in the presence of resonance absorbers; fuel depletion and its consequences; reactor kinetics; the neutron transport equation; group diffusion theory derived from the transport equation; the generation of equivalent diffusion-theory parameters; and advanced methods for reactor analysis. (JWR)

13605 SUBCRITICALITY MEASUREMENTS IN A HEAVILY REFLECTED REACTOR. Valko, J.; Por, G. (Magyar Tudomanyos Akademia, Budapest. Kozponti Fizikai Kutato Intezet). Atomkernenergie; 25: No. 1, 31-38(1975).

5 figs.; 1 tab.; 19 refs.

Previously reported theoretical results about the applicability of the Sjoestrand reactivity measuring method are experimentally verified. It is seen that in a heavily reflected reactor this method gives less space dependent reactivities than the Gozani method. The true value of the reactivity is determined from the detailed comparison of the numerically calculated and experimentally observed tendencies in the behaviour of the reactivity estimates as functions of reflected thickness, source shape and subcriticality. (auth)

13606 EINFUEHRUNG IN DIE KERNREAKTOR- UND KERNKRAFTWERKSTECHNIK. Teil I. Kernphysikalische Grundlagen, Reaktorphysik, Reaktordynamik. (Introduction to Nuclear Power. Part I. Physics, Dynamics). Oldekop, W. Thiemig-Taschenbuecher. Band 53. Munich; Verlag Karl Thiemig (1975). 287p.

A series of lectures on reactor technology given at the Braunschweig Technical University forms the basis of this book. The types of reactors are first briefly reviewed. The nuclear physics principles are then analyzed. Diffusion and slowing down of neutrons, reactor physics in the stationary state, and reactor dynamics are examined in sequence. (JSR)

Reactor Components and Accessories

Refer also to abstracts 11985, 12018–12020, 12149, 12174, 12213, 13559, and 13560.

13607 ANALYSIS OF A CRACK IN A NUCLEAR PRESSURE VESSEL NOZZLE USING THREE-DIMENSIONAL CRACK TIP SINGULARITY ELEMENTS. Schmitt, W. (Kraftwerk Union A. G., Erlangen, Ger.). Int. J. Pressure Vessels Piping.; 3: No. 2, 123-136(Apr 1975).

The safety analysis of a crack in a nuclear pressure vessel nozzle is evaluated. The determination of stress intensity factors by the methods of extrapolation of displacements, three-dimensional elastic crack tip elements, and application of Westergaard stress functions are considered. For a nuclear vessel with eight nearly identical nozzles, analyses were carried out for internal pressure loading, the upper half of the nozzle being of particular interest because of greater wall thickness. Results are discussed in terms of crack initiation and crack arrest. (UK)

13608 ADVANCES IN REFLECTIVE INSULATION ALLOW TIGHTER CONTROL OF COSTS AND SCHEDULES. Underwood, W. F. Power (N.Y.).; 119: No. 6, 110-112(Jun 1975).

The cost and performance advantages of reflective type thermal insulation systems in nuclear applications are described. Design and performance data are compared for reflective and bulk insulation. (DG)

13609 NEW IDEAS ADVANCE BELLOWS VALVES. Webb, M. J. Power (N.Y.).; 119: No. 6, 90-91(Jun 1975).

A description is given of improved materials, design, and test procedures for zero-external-leakage bellows type valves used in nuclear applications. (DG)

13610 EFFICIENCY OF ACOUSTIC EMISSION TESTING. McCormick, N. J.; Erdmann, R. C.; Stevens, C. A. (Science Applications, Inc., La Jolla, CA). Trans. Am. Nucl. Soc.; 21: 373(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13611 CAVEATS FOR THE BUYER OF TEST EQUIPMENT AND INSTRUMENTATION. Gage, L. W. (Nuclear Regulatory Commission, Washington, DC). Trans. Am. Nucl. Soc.; 21: 400-401(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13612 NUCLEAR UNIT AUTOMATED RECORDS MANAGEMENT SYSTEM FOR QUALITY ASSURANCE AND ENGINEERING. Benjamin, A. J.; Johnson, R. D. (Southwest Research Inst., San Antonio). Trans. Am. Nucl. Soc.; 21: 402(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13613 EFFECTS OF FREE CONVECTION ON TURBULENT FLOW MERCURY HEAT TRANSFER. Sesonske, A.; Eyler, L. L.; Klein, G. A. (Purdue Univ., West Lafayette, IN). Trans. Am. Nucl. Soc.; 21: 410-411(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13614 MIXING TEE RESULTS FROM THE MIXING COMPONENTS TEST FACILITY. Uherka, K. L.; Bump, T. R.; Kasza, K. E.; Rodin, M. B. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 411-412(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13615 ROD BUNDLE SUBCHANNEL VOID FRACTION BY GAMMA SCATTERING. Zielke, L. A. (Babcock and Wilcox Co., Alliance, OH); Howard, C. G.; Currie, R. L.; Morgan, C. D. Trans. Am. Nucl. Soc.; 21: 412-413(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13616 DIVERSION CROSS FLOW BETWEEN TWO COMMUNICATING PARALLEL FLOWS. Tapucu, A. (Univ. of Montreal); Llorente, J. C. Trans. Am. Nucl. Soc.; 21: 414-415 (Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13617 ADDITIONAL IMPROVEMENT ON CROSS-FLOW APPROXIMATION USED IN THE THERMAL-HYDRAULIC MULTICHANNEL ANALYSIS. Sha, W. T. (Argonne National Lab., IL); Szewczyk, A. A.; Ma, B. M. Trans. Am. Nucl. Soc.; 21: 419-420(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13618 APPLICATION OF HIGH EFFICIENCY POWER CONVERSION CYCLES TO NUCLEAR REACTORS. Powell, J. R.; Salzano, F. J.; Yu, W. S.; Mailau, J. S. (Brookhaven National Lab., Upton, NY). Trans. Am. Nucl. Soc.; 21: 423-424(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13619 SHIELDING DESIGN FOR BETTER PLANT AVAILABILITY. Biro, G. G. (Gibbs and Hill, Inc., New York). Trans. Am. Nucl. Soc.; 21: 510(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13620 LABYRINTH DESIGN IN NUCLEAR POWER PLANTS. Kaiseruddin, M. (Sargent and Lundy Engineers, Chicago). Trans. Am. Nucl. Soc.; 21: 514-516(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13621 REACTOR TYPES AND THEIR CONTAINMENT SYSTEMS. (International Atomic Energy Agency, Vienna). pp 11-29 of Neutron Irradiation Embrittlement of Reactor Pressure Vessel Steels. Steele, L. E. Vienna; International Atomic Energy Agency (1975).

See STI/DOC-10/163.

In order to identify step engineering problems related to radiation embrittlement, typical system construction is reviewed. Light-water reactors, gas-cooled reactors, pressure tube reactors, and fast breeder reactors are discussed. Operating reactors over the world and their vessed type are tabulated. General operating conditions are cited. Containment systems of concern are the ferritic steel vessels, where neutron fluences and stresses are high. (10 fig) (DLC)

13622 FEHLERBAUMANALYSE. Methode und Bildzeichen. Entwurf. (Fault Tree Analysis. Method and Symbols. Draft). Berlin; Beuth (1974). 9p.

6 figs.; 1 tab.

13623 CORROSION IN NUCLEAR TECHNOLOGY. Report on the Meeting of the Task Group of the European Federation of Corrosion in Karlsruhe. Borgstedt, H. U. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung). Atomwirtsch., Atomtech.; 20: No. 3, 131(Mar 1975). (In German).

Causes, effects and removal or prevention of corrosion are important in nuclear materials research. One of the main points of investigation is the behaviour of materials under reactor conditions in water, helium and sodium. The European Federation of Corrosion has established a special task group for these research problems. At the first meeting of the task group in the German Federal Republic, surveys of and contributions to select problems were discussed. (auth)

Reactor Fuels

Refer also to abstracts 11262, 11264–11269, 11658, 11925, 11962–11964, 11978, 12022, 12069, 12153, 12252, 12253, 12259, and 12260.

13624 (BNWL-1894) REVIEW OF METHODS APPLICABLE TO THE CALCULATION OF GAP CONDUCTANCE IN ZIRCALOY-CLAD UO_2 FUEL RODS. Lanning, D. D.; Hann, C. R. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Apr 1975. Contract AT(45-1)-1830. 44p. Dep. NTIS $4.00.

The program GAPCON-THERMAL-1 solves the steady-state temperature distribution in a reactor fuel rod by iterating on converging choices for the gap conductance. This conductance is calculated via a modification of the Ross–Stoute model. A review is made of data and calculational methods (in addition to those of Ross and Stoute) which are applicable to gap conductance. Various approaches to calculating the conductance through the gas and the conductance through contact points are compared. Conclusions and recommendations for the GAPCON program are presented. 15 references. (auth)

13625 (CONF-740319-) URANIUM/FUEL CYCLE 74, NEW ORLEANS, LOUISIANA, 17–20 MARCH 1974. Program Report. (Atomic Industrial Forum, Inc., New York (USA)). 1974. 63p. AIF $20.00; $10.00 members.

The highlights of papers presented at the conference are summarized. The sessions covered uranium raw material, transportation of spent fuel and radioactive waste, plutonium recycle, waste management, and safeguards. (JWR)

13626 FISSION-PRODUCT YIELD FROM DISPERSED NON-SPHERICAL FUEL PARTICLES INTO A MATRIX. Mikhlin, E. Ya. Sov. At. Energy (Engl. Transl.); 37: No. 3, 985-986(Sep 1974).

Translated from At. Energ. (USSR); 37: No. 3, 263-264(Sep 1974).

A method for the calculation of fission fragment flux density through the surface of a nonspherical fuel particle embedded in a matrix is presented. (JWR)

13627 A METHOD FOR PROTECTING HIGHLY IRRADIATED FUEL RODS. Kikindai, T. (Societe d'Etudes Chimiques, 92-Bourg-la-Reine (France)); Faugeras, P.; Lefort, G.; Leseur, A.; Miquel, P. (CEA, 75- Paris (France)). (to CEA). French Patent 2,207,330/A/. 21 Nov 1972. 10p. (In French).

Description is given of a method for protecting highly irradiated fuel-rods against the action of the water of a storage and transfer pool. This method is characterized in that it comprises forming on the fuel rod surface a protective coating of water-insoluble or poorly water-soluble organic material. The method can be applied to nuclear-reactor fuel rods during the treatment thereof prior to their transfer to a chemical dissolution installation. (FR)

13628 APPLICATION OF DIFFERENTIAL DYNAMIC PROGRAMMING TO NUCLEAR FUEL MANAGEMENT OPTIMIZATION. Fennern, L. E. Iowa City, IA; Iowa State Univ. (1974). 89p. University Microfilms Order No. 75-10,476.

Thesis (Ph. D.).

An approach to fuel management optimization using differential dynamic programming is presented. At each refueling period a decision must be made which determines the vector state of the fuel batch, defined as the average isotopic composition of the fuel for a given fuel region. The recycling of this fuel batch results in a multi-stage decision process with the levelized fuel cycle cost as the objective to be minimized. The vector state of the fuel after the end of each stage may be found using a state transition matrix determined from a depletion routine which may accommodate any degree of complexity in the reactor physics computations. The application of differential dynamic programming requires that the levelized fuel cycle cost function be expanded in terms of a truncated Taylor series about a set of state vectors. The coefficients of the series are determined by a nominal trajectory of state vectors over a given number of refueling stages. A search is conducted about this nominal trajectory until a more optimal trajectory is found which in turn becomes the nominal trajectory for the next iteration. Applications to batch fuel refueling, partial fuel refueling and fuel shuffling, and a recycle program between a LWR and LMFBR are presented. (Diss. Abstr. Int., B)

13629 THE STRUCTURE OF TURBULENT FLOW IN TRIANGULAR ARRAY ROD BUNDLES. Trupp, A. C.; Azad, R. S. (Manitoba Dept. of Agriculture, Winnipeg (Canada)). Nucl. Eng. Des.; 32: No. 1, 47-84(Apr 1975).

A wind tunnel study of fully developed uniform-density turbulent flow through triangular array rod bundles is described. Measurements were made for three tube spacings ($P/D = 1.20$, 1.35, and 1.50) over a Reynolds number range of 12,000–84,000. The data include friction factors, local wall shear stresses, and the distributions of mean axial velocity, Reynolds stresses and eddy diffusivities. The secondary flow pattern is inferred from the available evidence. (auth)

13630 PROCHNOST' TEPLOVYDELYAYUSHCHIKH ELEMENTOV YADERNYKH REAKTOROV. (Strength of Reactor Fuel Elements). Likhachev, Yu. I.; Pupko, V. Ya. Moscow; Atomizdat (1975). 280p.

A general theory is presented for calculating the stress-deformation state of reactor fuel elements while taking into account features of the thermomechanical stress and specific behavior of materials of construction and fissile material under the conditions of irradiation. A presentation is given of methods of calculating the strength of fuel elements of different types, both those having fuel and cladding which are tightly bonded to each other and also those having an intermediate liquid or gas layer. The integrity of the fuel element is determined in case of a surrounding inhomogeneity of thermal and neutron fields and unequal swelling of the shell material. A solution is presented to the problem of the stability of the elliptic shell of fuel elements under long-term, variable stress. The possible use of conjugate functions is considered for calculating perturbations in the stress-deformation state of fuel elements and for optimizing the strength characteristics of fuel elements. (SJR)

13631 CLADDING INELASTIC STRAIN IN MIXED-OXIDE FUEL RODS. Hilbert, R. F.; Peck, S. O.; Tuttle, N. M.; Stephen, J. D. (General Electric Co., Sunnyvale, CA). Trans. Am. Nucl. Soc.; 21: 187-188(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13632 PREDICTING FUEL ROD TEMPERATURE RESPONSES BY ORTHOGONAL COLLOCATION. Cena, R. J. (Battelle Pacific Northwest Labs., Richland, WA); Sather, N. F.; Rowe, D. S. Trans. Am. Nucl. Soc.; 21: 205-206(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13633 PROBABILISTIC MODELS FOR STEADY-STATE FUEL ROD TEMPERATURES. Chu, B. B. (Electric Power Research Inst., Palo Alto, CA). Trans. Am. Nucl. Soc.; 21: 206-207(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13634 EFFECTS OF INTRODUCING VARIABLE THERMAL CONDUCTIVITY IN A HEAT TRANSFER CODE. Rehbein, D. A. (Babcock and Wilcox Co., Lynchburg, VA); Carlson, R. W. Trans. Am. Nucl. Soc.; 21: 379-380(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13635 EFFECT OF GAS PRESSURE ON FUEL/SHEATH HEAT TRANSFER. Campbell, F. R.; DesHaies, R. (Atomic Energy of Canada Ltd., Chalk River, Ont.). Trans. Am. Nucl. Soc.; 21: 380(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13636 DEVELOPMENT OF STABLE DENSITY UO_2 FUEL. Heal, T. J.; Littlechild, J. E.; Watson, R. H. (BNFL, Springfields, Eng.). pp 52.1-52.3 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.

Fuel development work in BNFL has produced a technique by which irradiation stable UO_2 of any desired density can be fabricated and the criteria upon which this is based are discussed. (auth)

13637 ANALYSIS OF NUCLEAR FUEL ROD LOCALIZED STRESSES. Rashid, Y. R.; Wood, J. E.; Proebstle, R. A. pp 69.1-69.5 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.

An analytical model governing the thermo-mechanical response of nuclear fuel rods under transient power conditions is presented in the form of constitutive relations for both the clad and the fuel materials. Elastic-plastic effects, creep, swelling, fuel cracking and hot pressing are considered. The computational model is based on the finite element variational method and a time-difference procedure. Analysis results of an experimental fuel pin are presented and compared with measurements. (auth)

13638 NUCLEAR FUEL ROD ACTIVE GAMMA SCAN SYSTEM. Duckart, A. C. (General Electric Co., San Jose, CA); Ruiz, C. P.; Kosanke, H. D.; Menick, J. E. pp 70.1-70.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.

A system has been developed that verifies that each fuel pellet in every fuel rod manufactured at Wilmington has the proper enrichment. In addition to monitoring pellet enrichment, it detects any undesirable gaps between pellets and yields data on fuel density and contained U-235. The system has proven to be reliable, accurate and versatile for assuring very high quality in the control of fissile content and uniformity of manufactured fuel rods. 10 references. (auth)

13639 MODEL FOR FUEL ROD MECHANICAL AND THERMAL BEHAVIOR. Kjaer-Pedersen, N. (Elsinore Shipyard and Engineering Co., Denmark). pp 72.1-72.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.

A fast computational model for the description of fuel pellet and clad transient loading and interaction is presented. Materials' properties, geometry and space- and time-dependent power generation rate are input to the model which in turn calculates, for each point in time, temperature profiles, state of stress and state of elastic and plastic deformation under the basic assumption of axisymmetry. Axial-radial shear stress is taken into account as is yielding of the clad and anisotropic irradiation creep of both fuel and clad materials. 7 references. (auth)

13640 QUALITY: COMMON SENSE. Rahiser, R. H. pp 76.1-76.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.

The interpretation of the results in terms of statistical confidence levels and how all these functions relate in meeting the needs of the customer in terms of performance are analyzed. The quality system as it relates to these functions is described along with tools available today for implementing the program. The requirements placed upon the product reflects the importance of the characteristic and the use of the results by the knowledge and reliability of the information obtained. (auth)

13641 OVERPOWER-TO-FAILURE EXPERIMENT ON A HIGH BURNUP FUEL ROD. Rolstad, E.; Svanholm, K. (OECD, Halden, Norway). pp 77.1-77.3 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.

One of the fourteen fuel rods from Instrumental Fuel Assembly No. 4 (IFA-4), which has been irradiated in the Halden Reactor to an average burnup of 17 MWd/kg UO_2, has been overpower-to-failure tested. The experiment was made in a rig, IFA-229, equipped with a local power control system, using He^3 gas as neutron absorber. The overpower can with the He^3 system be introduced more rapidly than otherwise possible. After a "conditioning period" of approximately one day at 400 W/cm, the power was rapidly increased first from 400 to 480 W/cm and then from 480 to 610 W/cm average on the rod. The fuel failure detection system showed a strong indication of failure 15 minutes after reaching maximum power. Post-irradiation examination revealed that a large number of axial cracks had developed in the cladding along that region of the rod which had experienced a power increase larger than 340 W/cm relative to the power during the last period of operation in IFA-4. It was also seen that the overpower test had caused the "bamboo ridges" to increase, and that the position of the failure correlated well with the largest ridging. 5 references. (auth)

13642 THERMAL BEHAVIOR OF FUEL PINS FOR POWER REACTORS. Calza-Bini, A.; Cosoli, G.; Filacchioni, G.; Lanchi, M.; Nobili, A.; Rocca, U. V.; Rotoloni, P. L.; Marsico, B.; Trezza, G. (CNEN, Rome). pp 88.1-88.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.

The general aim of this experimental programme is to build up a semi-empirical calculation model to interpret the behaviour of a fuel pin under irradiation and to support the fuel designer in his work. A survey is being performed, both theoretically and experimentally, of the available data and a particular experimental effort is devoted to deepen some aspects of the physical phenomena which interest the fuel pin design because of their implication in safety, reactors operation and fuel performance improvement. This report deals with the results of the first part of the programme which concerns with the thermal behaviour of a fuel pin to be used in thermal reactors: to the purpose Zr-2 clads (15.06 mm outside diameter and 0.94 mm thickness) bearing UO_2, pellet and vipac, and UO_2-PuO_2, pellet and spherepac sol-gel were irradiated. 10 references. (auth)

13643 BEHAVIOR OF ZIRCALOY-UO_2 FUEL ELEMENTS WORKING AT LOW TEMPERATURE (300°C). Chagrot, M.; Ringot, C.; Vidal, H. (CEA, Saclay, France). pp 91.1-91.4 of Nuclear Fuel Performance. London; British Nuclear Energy Society (1973).

From international conference on nuclear fuel performance; London, UK (15 Oct 1973). See CONF-731004.

Some irradiation tests have been performed to verify the behaviour of an "applied" sheath in UO_2 - zircaloy fuel element, when there is an interaction between the fuel and the sheath due, for example, to a power increase. The ELO tests had three purposes: determine the failure mechanism, in view of making possible counter measures, select the more favourable cladding material, measure the strains resulting from power increases during normal reactor operation. The main results have shown that several rupture mechanisms exist, one being purely mechanical, and that it seems that a cladding having a high initial ductility has a better behaviour. (auth)

Reactor Control Systems

13644 (WANL-TME-117) POWER SOURCE FREQUENCY CONSIDERATIONS. McLane, F. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 4 Sep 1962. 3p. Dep. NTIS $4.00.

The NERVA Reactor Control System can be designed to operate from any of the power sources between 400 Hz and 3200 Hz that have been suggested, but there would be various advantages and disadvantages to changing from the 400 Hz power source originally planned. Advantages are: Transformers and magnetic amplifiers would be smaller and lighter. Some amplifiers presently planned as transistorized could be replaced with magnetic amplifiers. Magnetic amplifiers, in general, have higher reliability factors. Disadvantages are: 400 Hz equipment is readily available, but equipment for higher frequencies must be designed as needed requiring additional time and expense. Reliability information is available for standard 400 Hz equipment, but higher frequency equipment must undergo lengthy reliability tests. It is not considered to be advantageous to the Reactor Control System to change the power source frequency, but it could be designed at other frequencies if a significant advantage accrues in other components from such a change. (auth)

13645 (WANL-TME-533) PRELIMINARY CONTROL MALFUNCTIONS ON THE NRX-A2 REACTOR. Hafer, J. F. (Wes-

tinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 25 Sep 1963. 15p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

Preliminary malfunction studies have been run on the analog computer for the NRX-A2 reactor and control system. The malfunctions studied were single control drum failure, multiple control drum failures (up to five drums–nonrecoverable), control system hardware failures (all drums rotate out–all recoverable), and flow increase failures. Each malfunction was initiated with the reactor at 100% power and 100% flow. Single and up to four control drums multiple failure (at 45°/sec.) do not appear to damage the NRX-A2 reactor. The simultaneous failure of five or more control drums (nonrecoverable for scram) will damage the reactor. For a scram level of 150% power, scram delay times of 0.080 seconds or less are required to protect the reactor from damage. Flow increase malfunctions (100% to 150% flow) do not appear to damage the NRX-A2 reactor. (auth)

13646 (WANL-TME-1488) NERVA REACTOR CONTROL SYSTEM DESIGN CRITERIA. Walsh, J. M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1966. 18p. Dep. NTIS $4.00.

Declassified 12 Sep 1973.

The NERVA Reactor Control System (RCS) consists of reactivity control devices, power and temperature controls, temperature and nuclear instrumentation, and reactor safety equipment. The major components of the RCS are as follows: Reactivity control devices consisting of neutron absorbing, control drums, actuator system and tie tube, cooling hydrogen flow control, and valve actuator system. Power and temperature control systems consisting of start-up, power range, override, cooldown, and reactor safety controls. Instrumentation consisting of sensors and signal conditioning for reactor control and diagnostic functions. The NSS performance requirements pertinent to the RCS design criteria, the control methods, expected performance, reliability (including requirement to survive specified malfunctions, possibly at limited power), etc. are considered. (auth)

13647 (WCAP-8449) 17 × 17 DRIVE LINE COMPONENTS TESTS. Phase 1B, II, III D-Loop; Drop and Deflection. Cooper, F. W. Jr. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). Dec 1974. 54p.

A 24-rodlet control rod assembly and guide tube were tested for mechanical integrity and performance. The tests simulated reactor operation except for irradiation; the fuel rods in the 12-foot 17 × 17 fuel assemblies were lead-filled rather than fuel-filled. Three stages of testing imposed the equivalent of one year, 14 years, and 25 years (aggregating 40 years) of reactor operation. The 17 × 17 guide tube, control rod, and drive-rod-to-control-rod coupling met all applicable specifications with adequate performance margins. (auth)

13648 SPECTRAL AND CORRELATION ANALYSIS FOR MALFUNCTION DIAGNOSIS IN A NUCLEAR POWER SYSTEM. Mayo, C. W. Raleigh, NC; North Carolina State Univ. (1974). 213p. University Microfilms Order No. 75-10,413.

Thesis (Ph. D.).

An investigation was made into the theory and application of several spectral and correlation estimators to the inherent fluctuations in nuclear power system process parameters for the purpose of malfunction detection and diagnosis. Statistics considered were the single and joint probability density distributions, the auto and cross correlation functions, and the spectra associated with single input linear transfer function analysis. Specific interest was directed to the relative sensitivity of these estimators and techniques for implementing them as part of on-line instrumentation. Experimental study was performed on records obtained from the Robinson-2 Reactor, a 739 MW(e) pressurized water reactor operated by Carolina Power and Light Company at Hartsville, South Carolina. (Diss. Abstr. Int., B)

13649 STATUS OF THE CLINCH RIVER BREEDER REACTOR PLANT NUCLEAR STEAM SUPPLY SYSTEM. Jacobi, W. M. (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc.; 21: 357-358(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13650 EXPERIENCE OF THE DIAGNOSIS SYSTEM FOR A BWR. Murata, F. (Atomic Energy Research Lab., Kawasaki, Japan); Kato, K.; Kobayashi, S.; Niki, Y. Trans. Am. Nucl. Soc.; 21: 35-376(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13651 EUROPIA HEATING IN CONTROL RODS. Kidman, R. B. (Westinghouse Hanford Co., Richland, WA). Trans. Am. Nucl. Soc.; 21: 385(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13652 OPTIMIZING THE OPERATOR/EQUIPMENT INTERFACE AT THE HTGR CONTROL CENTER. Luna, S. F. (General Atomic Co., San Diego, CA); Raudenbush, M. H. Trans. Am. Nucl. Soc.; 21: 427(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13653 INFORMATION IN NEUTRON FLUCTUATIONS FOR DETECTION OF REACTOR ANOMALIES. McCormick, N. J. (Univ. of Washington, Seattle). Trans. Am. Nucl. Soc.; 21: 428-429(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13654 NEW INSTRUMENTATION AND CONTROL SYSTEM FOR FAST BURST REACTORS. Philbin, J. S.; Snyder, J. A.; Conant, J. C.; Sullivan, W. H. (Sandia Labs., Albuquerque, NM). Trans. Am. Nucl. Soc.; 21: 429-430(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13655 CONTROL ROD WORTH MEASUREMENTS IN SIMULATED LWR-Pu ENVIRONMENT IN THE FTR. Bhattacharyya, S. K.; Pond, R. B.; Smith, D. M.; Robinson, W. R. (Argonne National Lab., IL). Trans. Am. Nucl. Soc.; 21: 450-451(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13656 Eu_2O_3 AND B_4C WORTH CALCULATIONS IN FAST REACTOR SPECTRA. Daughtry, J. W. (Westinghouse Hanford Co., Richland, WA). Trans. Am. Nucl. Soc.; 21: 451-452(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13657 FTR EUROPIA GAMMA HEATING. Ward, J. T. Jr. (Westinghouse Hanford Co., Richland, WA). Trans. Am. Nucl. Soc.; 21: 453-454(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13658 EFFECT OF DILUTION AREA ON CONTROL ROD REACTIVITY WORTH CALCULATIONS. Nakata, H.; Hukai, R. Y. (Instituto de Energia Atomica, Sao Paulo, Brazil). Trans. Am. Nucl. Soc.; 21: 462-463(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13659 HEAVY-WATER CRITICAL EXPERIMENTS FOR FUGEN (III) CONTROL ROD EFFECTS. Matsumoto, M. (Power Reactor and Nuclear Fuel Development Co., Tokyo); Haga, T.; Ueda, M. Trans. Am. Nucl. Soc.; 21: 466(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13660 CONSIDERATIONS ON VALIDITY OF DISTURBANCE METHOD PREDICTING INTERACTION EFFECT ON CONTROL ROD WORTH. Konishi, T.; Yamamoto, M. (Atomic Energy Research Labs., Kawasaki, Japan). Trans. Am. Nucl. Soc.; 21: 497(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13661 NUCLEAR INSTRUMENTATION. Strauss, S. D. Power (N.Y.).; 119: No. 6, S1-S16(Jun 1975).

A description of reactor instrumentation is provided under the following topics: a review of reactor basics, fundamentals of radiation detectors, role of in-core instrumentation, how out-of-core devices are used, and protecting the human environment. (DG)

13662 SUMMER COMPUTER SIMULATION CONFERENCE. Volume I. Proceedings of the Conference Held at Houston, Texas, July 9–11, 1974. La Jolla, CA; Simulation Councils, Inc. (1974). 537p. (CONF-740703–P1). AFIPS Press, Montvale, NJ.

Separate abstracts were prepared for 2 of the papers included. The remaining papers are outside the scope of NSA. (JWR)

For abstracts of individual papers see: 13663 and 13664.

13663 HYBRID SIMULATION OF A PWR NUCLEAR STEAM SUPPLY SYSTEM. Stansbury, M. C. (Brown and Root, Inc., Houston, TX); Courtney, J. C.; Chen, E. pp 481-491 of Summer Computer Simulation Conference. Vol. I. La Jolla, CA; Simulation Councils, Inc. (1974).

From computer simulation conference; Houston, Texas, USA (9 Jul 1974). See CONF-740703-P1.

A lumped-parameter dynamic model of a PWR type reactor for use with a hybrid computer was developed. A display and control panel was included to permit monitoring of several parameters at once. The simulator is useful for training in reactor operation and control functions. (JWR)

13664 REAL-TIME DYNAMIC SIMULATION FOR THE BRUCE NUCLEAR GENERATION STATION. Luxat, J. C. (DCF Systems Ltd., Toronto). pp 496-502 of Summer Computer Simulation Conference. Vol. I. La Jolla, CA; Simulation Councils, Inc. (1974).

From computer simulation conference; Houston, Texas, USA (9 Jul 1974). See CONF-740703-P1.

The design and implementation of a mini-computer-based real-time dynamic simulator for the Bruce Nuclear Generating Station is outlined. The function of the simulator is to provide a facility for debugging and pre-commissioning testing of computer control programs developed for the station. Details of the plant dynamics model and of the organization of the simulator software package are presented. (auth)

Nuclear Power Plant Economics

13665 LES CENTRALES NUCLEAIRES. (The Nuclear Power Plants). Parreins, G. Paris, France; Presses Universitaires de France (1974). 128p. (In French).

The scientific principles are outlined, after which the state of atomic accomplishments and the development of current projects are described. The economics are analyzed in detail. The different kinds of existing stations are reviewed: natural uranium nuclear stations and those using enriched uranium and light water; advanced nuclear stations (breeders, H.T.R.'s, A.G.R.'s, heavy water-moderated reactors,) still at the experimental stage. The main characteristics and the location of most reactors are tabulated. Reactor safety, spent fuel storage, and the price per kilowatt-hour are discussed. The national electronuclear programs up to 1985 are given for many countries. (FR)

13666 THE NUCLEAR PROGRAM OF ELECTRICITE DE FRANCE FACING THE ENERGY CRISIS. Boiteux, M. (Electricite de France, 75- Paris). Rev. Fr. Electr.; 47: No. 247, 6-7, 10-11, 14-15(1974). (In French).

The possibilities offered by nuclear power in facing the difficulties in supplying primary energy are examined and the nuclear program of Electricite de France as it appears now (acceleration of the program, technical choice, cost and investments, fissile materials, environment and safety) is described. (FR)

13667 UNCERTAINTIES OF THE NUCLEAR DEVELOPMENT IN THE UNITED STATES. Grenon, M. Rev. Energ.; 25: No. 268, 461-467(Dec 1974). (In French).

The American atomic energy situation is discussed sector by sector, and each sector is shown to be in difficulty in one way or another. Cancelled orders and sliding schedules for nuclear power stations are increasing. The availability coefficient of nuclear stations is debated and it seems that the fast breeder programme will have to slow down. No commercial spent fuel reprocessing plant is working in the United States at present. Doubts in the uranium enrichment field concern needs, the role of private industry and techniques. All these uncertainties combine, add up and multiply to upset the natural uranium market. (FR)

13668 NEEDS: NUCLEAR ENERGY ELECTRICAL DEMAND SIMULATION. Willke, T. L. (Battelle Columbus Labs., OH). Trans. Am. Nucl. Soc.; 21: 257(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13669 ECONOMICS OF NUCLEAR PLANT SAFETY REGULATION. Linnerooth, J. (International Inst. for Applied Systems Analysis, Vienna). Trans. Am. Nucl. Soc.; 21: 387-388(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13670 DESCRIPTION AND USAGE OF RADWASTE-DISPOSAL COST COMPUTER PROGRAM, RWECONO. Creswell, J. S.; Katonak, L. E. (Ebasco Services, Inc., Norcross, GA). Trans. Am. Nucl. Soc.; 21: 444-445(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13671 TECHNICAL SOLUTIONS FOR THE UTILIZATION OF NUCLEAR PROCESS HEAT FOR THE HEATING MARKET. Schulten, R.; Kugeler, K. (Kernforschungsanlage Juelich G. m. b. H. (F. R. Germany). Inst. fuer Reaktorentwicklung). Elektrotech. Z., A; 96: No. 1, 2-11(1975). (In German).

15 figs.; 2 tabs.; 10 refs.

The development of nuclear process heat is of interest from the economic point of view because: (1) nuclear process heat is cheaper than fossil fuel sources; (2) the small contribution of the cost of uranium to the heat price makes the heating costs for an installation remain almost constant during operation; (3) for coal gasification it is possible to produce almost double the quantity of gas from the same amount of coal as with conventional gasification; (4) it is possible to transmit nuclear heat over long distances at low cost so that the nuclear installations can be built at a great distance from densely populated areas. (auth)

13672 THE SUPPLY OF THE FEDERAL REPUBLIC OF GERMANY WITH LONG-DISTANCE-HEAT BY A FEDERAL LINE. Bruns, P. H.; Krischke, H.; Moellenkamp, F. W. (Steinkohlen-Elektrizitaet A. G. (STEAG), Essen (F. R. Germany). Geschaeftsbereich Anlagentechnik). Energie.; 27: No. 1, 4-9 (Jan 1975). (In German).

6 figs.; 2 tabs.; 3 refs.

Energy carriers such as electricity, mineral oil products, natural gas, and synthetic gases can be transported with the the aid of a coordinate industrial system by cables and pipe-lines. The feasibility of supplying the whole Federal Republic of Germany with heat by a communicating pipe-line system and how much energy could be saved by such a system are examined. (GE)

13673 ECONOMIC GROWTH AND ENERGY DEMAND. Simon, W. (Siemens A. G., Erlangen (F. R. Germany). Unternehmensbereich Energietechnik). Siemens-Z.; 48: No. 11, 807-817(Nov 1975). (In German).

5 figs. Shortened and revised version of a report presented at the meeting: Has economic growth reached its limits, Tutzing, F. R. Germany, 5-6 Feb 1974.

Economic growth is increasingly turning into a compromise between individual living standards and public well-being or between progress and limited resources. Power consumption plays a key role. The problems of economic growth and power consumption are discussed. Signs of a slowdown are recognizable in the Federal Republic of Germany, a country with a high rate of growth and heavy power consumption. The main growth sectors are already reaching the saturation point and this is naturally reflected in power consumption. Nuclear power will govern the primary source of energy in future. (auth)

13674 MAINTENANCE REQUIREMENTS IN THE PLANNING OF NUCLEAR POWER PLANTS. Berners, O. (Kraftanlagen A. G., Heidelberg (F. R. Germany)). pp 136-147 of Vortraege: Kraftwerke 1974. Essen, VGB-Dampftechnik (1974). (In German).

From congress power plants 1974. Annual meeting of the VGB; Dortmund, F. R. Germany (9 Jul 1974). 10 figs. With abstract.

Restricted space and impractical arrangement of valves and lines increase the radiation exposure during maintenance. This leads to increased numbers of personnel needed and entails problems and higher costs for all partners, i.e., operating staff, suppliers and service companies. Some improvements are suggested on the basis of examples from existing nuclear power plants, and a cost-benefit-analysis is given. (GE)

13675 FUEL ELEMENTS FOR LWR, HTR, SNR, GSB. Summary of the State Report of the KTG-Fachgruppe "Brennelemente" on 12/13. 11.74 in the Kernforschungsanlage Juelich. Krawczynski, S. J. B. (Kernforschungsanlage Juelich G. m. b. H. (F. R. Germany). Zentralabteilung Brennelement-und Bestrahlungstechnologie); Theyman, W. (Hochtemperatur-Reaktorbau G. m. b. H., Mannheim (F. R. Germany)); Mayer, H. (Internationale Atomreaktorbau G. m. b. H. (INTERATOM), Bensberg/Koeln (F. R. Germany)); Kleine-Tebbe, A. (Hochtemperatur-Reaktorbau G. m. b. H., Juelich (F. R. Germany). Versuchsabteilung). Atomwirtsch., Atomtech.; 20: No. 4, 213-215(Apr 1975). (In German).

At their 1974 professional meeting which was organized together with the KFA Juelich GmbH, the task group "fuel elements" of the Kerntechnische Gesellschaft discussed relevant questions of fuel element layout, development, production, and the formation of the fuel cycle. The problems were discussed in four groups for four types of reactors. The subject of each group was observed by a panel and treated in short lectures for the different types of reactors. A survey drawn up by the vice-chairmen of the different groups who formed the programme panel is presented. (GE)

Reactor Fuel Cycle Economics

Refer also to abstract 11517.

13676 (LBL-3682) QUANTITIES OF ACTINIDES IN NUCLEAR REACTOR FUEL CYCLES. Ang, K. P. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 9 Apr 1975. Contract W-7405-ENG-48. 198p. Dep. NTIS $13.00.

Thesis.

The quantities of plutonium and other fuel actinides have been calculated for equilibrium fuel cycles for 1000 MW reactors of the following types: water reactors fueled with slightly enriched uranium, water reactors fueled with plutonium and natural uranium, fast-breeder reactors, gas-cooled reactors fueled with thorium and highly enriched uranium, and gas-cooled reactors fueled with thorium, plutonium, and recycled uranium. The radioactivity levels of plutonium, americium, and curium processed yearly in these fuel cycles are greatest for the water reactors fueled with natural uranium and recycled plutonium. The total amount of actinides processed is calculated for the predicted future growth of the United States nuclear power industry. For the same total installed nuclear power capacity, the introduction of the plutonium breeder has little effect upon the total amount of plutonium processed in this century. The estimated amount of plutonium in the low-level process wastes in the plutonium fuel cycles is comparable to the amount of plutonium in the high-level fission product wastes. The amount of plutonium processed in the nuclear fuel cycles can be considerably reduced by using gas-cooled reactors to consume plutonium produced in uranium-fueled water reactors. These, and other reactors dedicated for plutonium utilization, could be co-located with facilities for fuel reprocessing and fuel fabrication to eliminate the off-site transport of separated plutonium. (auth)

13677 THE UTILIZATION OF FUEL IN DIFFERENT NUCLEAR SYSTEMS: GRAPHIC COMPARISON. Ventre, M. (Electricite de France, 75- Paris). Rev. Energ.; 26: No. 269, 490-497(Jan 1975). (In French).

A simple graphic method was used to compare different nuclear lines. This method underlines the fuel requirements, and the quantity of residues and wastes produced for each of them. The reference value is the net electric power. (FR)

13678 APPLICATION OF DIFFERENTIAL DYNAMIC PROGRAMMING TO RECYCLE FUEL MANAGEMENT OPTIMIZATION. Fennern, L. E. (General Electric Co., San Jose, CA); Rohach, A. F. Trans. Am. Nucl. Soc.; 21: 260-261(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13679 TOTAL ENERGY INVESTMENT IN NUCLEAR POWER PLANTS. Rombough, C. T. (Babcock and Wilcox Co., Lynchburgh, VA); Koen, B. V. Trans. Am. Nucl. Soc.; 21: 386-387 (Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13680 NUCLEAR COST UNCERTAINTIES AND ENERGY CHOICES. de la Fuente, H. (Comision Federal de Electricidad, Piso Anexo, Mexico); Martin, J.; Mulas, P. Trans. Am. Nucl. Soc.; 21: 387(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

Reactor Licensing and Regulation

13681 (FIND-50346) FIND: DAVIS-BESSE NUCLEAR POWER STATION. Williams, W. H. (ed.). (Energy Research and Development Administration, Oak Ridge, Tenn. (USA). Technical Information Center). Jul 1975. 36p. Dep. NTIS $4.00

This index is presented for microfiche material of Docket 50346, Davis-Besse Nuclear Power Station. The material includes that submitted by Toledo Edison Company in behalf of itself and Cleveland Electric Illuminating Company, in conjunction with their application for an Operating License for Davis-Besse. Also included is correspondence from the Atomic Energy Commission (now the Nuclear Regulatory Commission) and various agencies and interested parties. The microfiche items date from Aug. 1, 1969–March 1975. (auth)

13682 (NRCI-75/4) NUCLEAR REGULATORY COMMISSION ISSUANCES, APRIL 1975. (Energy Research and Development Administration, Oak Ridge, Tenn. (USA). Technical Information Center). Jun 1975. 204p. TIC $4.00.

The issuances received during the specified period from the Commission (CLI), the Atomic Safety and Licensing Appeal Boards (ALAB), and the Atomic Safety and Licensing Boards (LBP) are presented. (auth)

13683 (NRCI-75/5) NUCLEAR REGULATORY COMMISSION ISSUANCES, MAY 1975. (Nuclear Regulatory Commission, Washington, D. C. (USA)). Jun 1975. 62p. TIC $4.00.

Issuances received during the specified period from the Commission (CLI), the Atomic Safety and Licensing Appeal Boards (ALAB), and the Atomic Safety and Licensing Boards (LBP) are presented. (auth)

13684 (RDT-STATUS-6-75) BIMONTHLY STATUS REPORT OF RDT STANDARDS. (USAEC Division of Reactor Research and Development, Washington, D. C.). 30 May 1975. 57p. RSO.

13685 LMFBR LICENSING: COMPARISON WITH OTHER REACTOR DESIGNS. Bradbury, P. (Westinghouse Electric Corp., Madison, PA). Trans. Am. Nucl. Soc.; 21: 276-277 (Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13686 UTILITY EXPERIENCE WITH THE REPLICATION OPTION OF STANDARDIZATION. Falkin, N. (Long Island Lighting Co., Hicksville, NJ). Trans. Am. Nucl. Soc.; 21: 361 (Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13687 VENDOR PERSPECTIVE ON IMPLEMENTATION OF STANDARD OPTIONS. Eicheldinger, C.; McEwen, J. E. (Westinghouse Electric Co., Pittsburgh). Trans. Am. Nucl. Soc.; 21: 361-362(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13688 LOOK AT STANDARD REVIEW PLANS. Faulkner, H. J. (Nuclear Regulatory Commission, Washington, DC). Trans. Am. Nucl. Soc.; 21: 362(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13689 SNUPPS: NUCLEAR PLANT STANDARDIZATION. Petrick, N. A. (SNUPPS, Gaithersburg, MD). Trans. Am. Nucl. Soc.; 21: 362-363(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13690 IMPLEMENTATION OF A STANDARDIZATION PROGRAM. Stuart, I. F.; Hughes, E. A. III. (General Electric Co., San Jose, CA). Trans. Am. Nucl. Soc.; 21: 363(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13691 CONSIDERATIONS FOR THE DEVELOPMENT OF A STANDARDIZED REFERENCE NUCLEAR POWER PLANT DESIGN. Kent, G. F.; Wille, D. J. (Stone and Webster Engineering Corp., Boston). Trans. Am. Nucl. Soc.; 21: 363-364(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13692 RECENT STATE LAWS ON POWER PLANT SITING. Evans, V. A. (Commonwealth Associates, Inc., Jackson, MI). Trans. Am. Nucl. Soc.; 21: 399(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13693 TEXAS NUCLEAR POWER POLICIES: A STUDY OF ALTERNATIVES. Vanston, J. H. Jr.; Woodson, H. H. (Univ. of Texas, Austin). Trans. Am. Nucl. Soc.; 21: 399-400(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

GENERAL AND MISCELLANEOUS

Energy Utilization and Economics

13694 OVERVIEW OF NON-NUCLEAR ENERGY TECHNOLOGIES. Bresee, J. C. (Energy Research and Development Administration, Washington, DC). Trans. Am. Nucl. Soc.; 21: 141(Jun 1973).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

Management

Refer also to abstract 11696.

13695 (NP-20318) NATIONAL INSTITUTE OF NUCLEAR ENERGY. Delgado, C. M. (Universidad Nacional Autonoma de Mexico, Mexico City. Facultad de Derecho). 1974. 132p. (In Spanish). Dep. NTIS (US Sales Only) $9.75.

Thesis.

The legislation governing nuclear energy in Mexico is outlined and critically evaluated. The Latin American cooperative efforts for the development of energy resources are reviewed. A comparative analysis is made of the legislation creating the Comision Nacional de Energia Nuclear and Instituto Nacional de Energy Nuclear. The organization and purposes of international organizations concerned with nuclear energy are reviewed. (JSR)

13696 NUCLEAR POWER. Technical Bases for Ethical Concern. Lovins, A. B. London, Eng.; Friends of the Earth Ltd., London for Earth Resources Research Ltd. (1974). 52p. Earth Resources Research Ltd.

An annotated semi-technical assessment of the impact of human fallibility and malice on some highly engineered and persistently hazardous systems; a survey of social and institutional implications; and a brief discussion of certain policy problems and prospects. The subject is dealt with in sections, entitled: fundamental issues; reactor safety; fuel transport and reprocessing; waste management; plutonium toxicity; safeguards; nuclear power and public policy. (auth)

13697 NUCLEAR ENERGY: A PROTOTYPE FOR RESOURCE SALVAGE. Carter, R. L. (Univ. of Missouri, Columbia). Trans. Am. Nucl. Soc.; 21: 88-89(Jun 1975).

From transactions of the American Nuclear Society 1975 annual meeting; New Orleans, LA (8 Jun 1975).

13698 PUBLIC WORKS FOR WATER AND POWER DEVELOPMENT AND ATOMIC ENERGY COMMISSION APPROPRIATION BILL, 1975. Part 4. Hearings Before a Subcommittee of the Committee on Appropriations, House of Representatives, Ninety-Third Congress, Second Session. Washington, DC; Committee on Appropriation (1974). 1084p. GPO.

Justification materials are given for the following programs: nuclear materials, weapons, naval reactors, civilian reactor research and development, reactor safety, applied energy technology, and space nuclear systems. (DLC)

13699 FROM AEC TO ERDA AND NRC. Reorganization of Energy Research and Development in the Government of the USA. Patermann, C. (Botschaft der Bundesrepublik Deutschland, Washington, D. C. (USA)). Atomwirtsch., Atomtech.; 20: No. 3, 114-116(Mar 1975). (In German).

9 refs.

As a consequence of the Energy Reorganization Act of 1974 the U. S. Federal Government fundamentally reorganized the entire sector of energy research and development. The nuclear sector is affected in particular by the dissolution of the USAEC after 27 years of existence and the execution of former AEC duties by the two newly created organizations of ERDA and NRC. (auth)

Mathematics and Computers

13700 (LA-UR-74-1915) ALGORITHMS TO REVEAL GRAPHIC TERMINAL CHARACTERISTICS. George, J. E. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-eng-36. 23p. (CONF-750623-1). Dep. NTIS $4.25.

From 2nd annual conference on computer graphics and interactive techniques; Bowling Green, Ohio, USA (25 Jun 1975).

Algorithms to discover graphic terminal characteristics are presented as a set of Standard Fortran subroutines as an aid in developing portable and device independent graphical systems. The algorithms compute the screen representation, the character sizes, the incremental vector action, and the boundary action in both the character and graphic mode. The assumptions, restrictions, and implications of the algorithms are discussed. (auth)

Miscellaneous

13701 (UCRL-52000-75-5) LAWRENCE LIVERMORE LABORATORY ENERGY AND TECHNOLOGY REVIEW. Carr, R. B.; Coyle, P. E.; Barnett, J. M.; Berlo, R. C.; McCaleb, C. S.; Prono, J. K. (eds.). (California Univ., Livermore (USA). Lawrence Livermore Lab.). May 1975. Contract W-7405-Eng-48. 24p. Dep. NTIS $4.00.

Three abbreviated briefs are given of recent developments: laser fusion neutron yields, dynamite tagging, and hydrogeochemical survey of uranium sources. Four articles are also included: aerial prospecting of geothermal resources, seismic response analysis of a nuclear fuel fabrication plant, radon sealants for uranium mines, and computer-controlled multiple-actuator shaker. (DLC)

13702 INTERNATIONAL BUYER'S GUIDE 1975. London; Nuclear Engineering International (Mar 1975). 97p.

A world guide to manufacturers and suppliers of equipment and services to the nuclear power industry and for the nuclear needs of research, medicine, and environmental monitoring is presented. It includes over 1700 companies and organisations and approximately 50 groupings of products and services. (UK)

Materials

13703 (BDX-613-1111(Rev.)) EXPERIMENTAL TESTING FOR MOLD TEMPERATURE RESPONSES. Floersch, R. H. (Bendix Corp., Kansas City, Mo. (USA)). May 1975. Contract AT(29-1)-613. 123p. Dep. NTIS $5.45.

An extensive mold testing program was established, in an attempt to achieve adequate models of mold temperature response to various heat transfer fluid temperature forcings. The results of those tests are presented. In addition, attempts were made to correlate the observed responses to assumed linear response models. These results are included, with pertinent discussion concerning the observed responses. (auth)

13704 (BNL-16890) FINITE ELEMENT APPROACH TO POLYMER CONCRETE BRIDGE DECK DESIGNS ANALYSIS. Report on Polymer Concrete Applications Development for the Bureau of Public Roads. Reich, M.; Koplick, B.; Hendrie, J. M. (Brookhaven National Lab., Upton, N. Y. (USA)). May 1972. 104p. Dep. NTIS $8.25.

The investigation develops the analytical techniques to guide the design of crack-free concrete-polymer bridge decks and to aid in better understanding of the crack phenomena occurring in present-day concrete bridge decks. It was considered desirable to extend the analytical techniques to include the prediction of crack patterns for the total range of loading from zero to ultimate. The effort engages two tasks. The first deals with the bridge deck response in the elastic range while the second involves the extension to inelastic behavior. Progress is reported on the bridge deck elastic analysis and design. The inelastic behavior study is in the formulation stage. The thickness of the bridge deck can vary considerably and that affects the analysis method. Concrete designs 12 to 24 inches in thickness, using various reinforcement schemes, are usual. Polymer concrete designs can be only 2 to 3 inches thick, due to the four-fold increase in compressive strength as compared with regular concrete. (MCW)

13705 (BNL-tr-602) SPECIFIC HEAT OF ANHYDROUS $CrCl_3$ BETWEEN 4.5 AND 20 K IN A MAGNETIC FIELD. Kostryukova, M. O.; Luk'yanova, L. V. Translated by S. J. Amoretty from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 17: No. 2, 78-81(1973). 8p. Dep. NTIS $4.00.

Anhydrous $CrCl_3$, a layered antiferromagnet in which antiferromagnetic ordering occurs at $T_c = 16.8$ K, exhibits properties of two-dimensional ferromagnetism. The behavior of the specific heat of $CrCl_3$ in a magnetic field was studied and the specific heat of $CrCl_3$ in fields up to 8 kOe was measured in the temperature range from 4.5 to 20 K. The anisotropy of $CrCl_3$ is negligible and powdered $CrCl_3$ was used. An approximate 30-g sample of powder pressed into cylindrical shape was placed in a calorimeter in a transverse magnetic field product by an electromagnet. Measurements of the specific heat in external fields of 870, 5800, and 8100 Oe are plotted. Results are discussed. (MCW)

13706 (BNWL-CC-641) DISCUSSION OF SOME ALUMINATE PELLET FABRICATION VARIABLES RELATED TO PT-NR-66. Gurwell, W. E. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 28 Apr 1966. 12p. Dep. NTIS $4.00.

Declassified 11 Jun 1973.

Progress is reported on the fabrication of lithium aluminate pellets. After characterizing the powder spectrochemically, the

process is described. The process involves drying at 600 C for 2 hours; ball milling for 7 hours; organics blended in; pressing at 40,000 psi; organics baked out; sintering at 1325 C; and inspection. (MCW)

13707 (IS-M-26) STATISTICAL THEORY OF MAGNETIC EXCITATIONS IN HEISENBERG PARAMAGNETS. Liu, S. H.; Swanson, P. A. (Iowa State Univ. of Science and Technology, Ames (USA)). 1974. 7p. (CONF-741202-28). Dep. NTIS $4.00.

From 20th annual conference on magnetism and magnetic materials; San Francisco, California, USA (3 Dec 1974).

A statistical method is proposed to calculate the dynamical correlation function G(q vector,t) equals [S vector/sub q vector/(t). S vector /sub -q vector/(0)] for the Heisenberg model above the ordering temperature. The function may be expanded into a power series of the time and coefficients are expressed in terms of static multi-spin correlation functions. In the limit lambda is greater than q^{-1} greater than r, where lambda is the spin correlation length and r is the range of interaction, the dominant contributions to the coefficients come from spins within correlated clusters. The dynamics of such a cluster is treated by the spin-wave theory for an infinite crystal, then the contribution of each cluster is weighed to G(q vector,t) according to its probability. The result is that the excitations in the range qlambda greater than 1 are magnon-like modes broadened by a mean-free-path measured by lambda. In addition, there is a central peak at zero frequency, which is the diffused remnant of the magnetic Bragg peak. The theory compares favorably with the neutron scattering data on TMMC and nickel. (auth)

13708 (JINR-P14-8480) ENERGIES OF ELECTRONIC MULTIPLETS OF Pr^{3+} IN VARIOUS CRYSTAL HOSTS. Matthies, S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1974. 20p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The matrix of the free-ion Hamiltonian is reported, which determines the centers of gravity of the $(4f)^2$ electronic multiplet energies and depends on parameters, replacing in a half-empirical treatment the radial integrals of the operators of the Coulombic repulsion interaction between the 4f-electrons, their spin-orbit, configuration, orbit-orbit, spin-spin and spin-other orbit interactions. The parameters for Pr in LaF_3 and in other crystal hosts are given. (tr-auth)

13709 (SAND-75-8613) SINTERING BY SIMULTANEOUS INDEPENDENT MECHANISMS. German, R. M.; Munir, Z. A. (Sandia Labs., Livermore, Calif. (USA)). Mar 1975. Contract AT(29-1)-789. 29p. Dep. NTIS $4.50.

A simple model based on additive neck growth rates is developed for independently acting mechanisms. The resulting expression is solved for the cases of surface plus volume diffusion and surface plus grain boundary diffusion. Analysis of Cu and Ag sintering data demonstrates the usefulness of the model. (auth)

13710 (UCID-16718) DEPOSITION OF THIN, TAPERED ALUMINUM FILMS. Hsieh, E. J.; Brown, T. G.; Vindelov, K. E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 5 Mar 1975. Contract W-7405-Eng-48. 14p. Dep. NTIS $4.00.

A tapered film is defined as one in which the thickness changes monotonically in a given direction. The experimental setup and procedures to obtain a tapered aluminum film with a linear thickness gradient are described. (auth)

Physics and Engineering

13711 (JUL-1102-RG) NUMERICAL CALCULATIONS OF ENERGY CONVERSIONS AND TEMPERATURES OF STEEL IN THE ELECTRIC ARC FURNACE. Walbeck, M. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorentwicklung). Aug 1974. 129p. (In German). Dep. NTIS (US Sales Only) $9.50.

Thesis. Submitted to Technische Hochschule, Aachen.

A survey of conventional processes for steel production and a description of electric-furnace steel melting is made, whereby special melting techniques and recent developments for improving the operation of electric arc melting are considered. Thereafter the basic equations for calculating the energy conversions and the temperatures for a cylindrical furnace are listed. Thermal conductivity, specific heat, density, and overall conversion are studied as a function of the temperature. For the evaluation of the basic equations, the continuum is divided up into discrete elements. Mean parameters of state are assigned to the elements. The energy flux to the various elements, its transposition in them, and the temperatures are calculated successively as a function of time in a number of cases. A comparison is made of the computed values with data from literature and all the values are discussed. (tr-auth)

13712 (ORO-3992-200) COMPLETELY POSITIVE DYNAMICAL SEMIGROUPS ON N-LEVEL SYSTEMS. Gorini, V.; Kossakowski, A.; Sudarshan, E. C. G. (Texas Univ., Austin (USA). Center for Particle Theory). 1974. 29p. (CPT-244). Dep. NTIS $4.75.

Under general assumptions, a proof is given of complete positivity of the dynamical evolution of a quantum open system and a theorem established which characterizes all completely positive dynamical semigroups of an n-level system. The result is applied to derive explicit inequalities among the physical parameters characterizing the Markoffian evolution of a two-level system. (auth)

13713 (UCRL-Trans-10718) PROPAGATION VELOCITY OF ULTRASOUND AT FREQUENCIES OF 0.62–10 MHz IN n-HEXANE, n-HEPTANE, n-OCTANE AND CYCLOHEXANE AT PRESSURES UP TO 2500 ATM AND TEMPERATURES UP TO 120°C. Golik, A. Z.; Adamenko, I. I.; Varetskii, V. V. Translated from Ukr. Fiz. Zh. (Russ. Ed.); 17: No. 12, 2048-2052(1972). 10p. Dep. NTIS $4.00.

The methods and the results of studying the velocity of ultrasound propagation in n-hexane, n-heptane, n-octane, and cyclohexane within a frequency range of 0.62 to 10 MHz at pressures up to 2500 atm and temperatures up to 120°C are described. It is shown that within these ranges of temperatures, pressures, and frequencies there is no dispersion of the velocity of sound. For liquids the P-V-T relationship of which is described by Tate's equation $\rho^2 c^2/\gamma$ dependence on pressure is linear. At pressures from 1 to 2000 atm a regularity is observed in the location of the sound polytherms: the greater the energy of collective interaction, the greater is the velocity within the studied ranges of T and P. At pressures of 2000 atm and higher, the differences in ultrasound velocities for all the liquids studied are within the experimental error. Using the Bridgman model comprising two mechanisms of the effect of pressure on the liquids' structure, the authors come to a conclusion that with rising pressure the character of the packing of n-hexane, n-heptane, and n-octane particles changes in a similar way, and at 2000 to 2500 atm it is similar to the character of the packing of cyclohexane molecules. (auth)

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